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A FAWCETT MAGAZI

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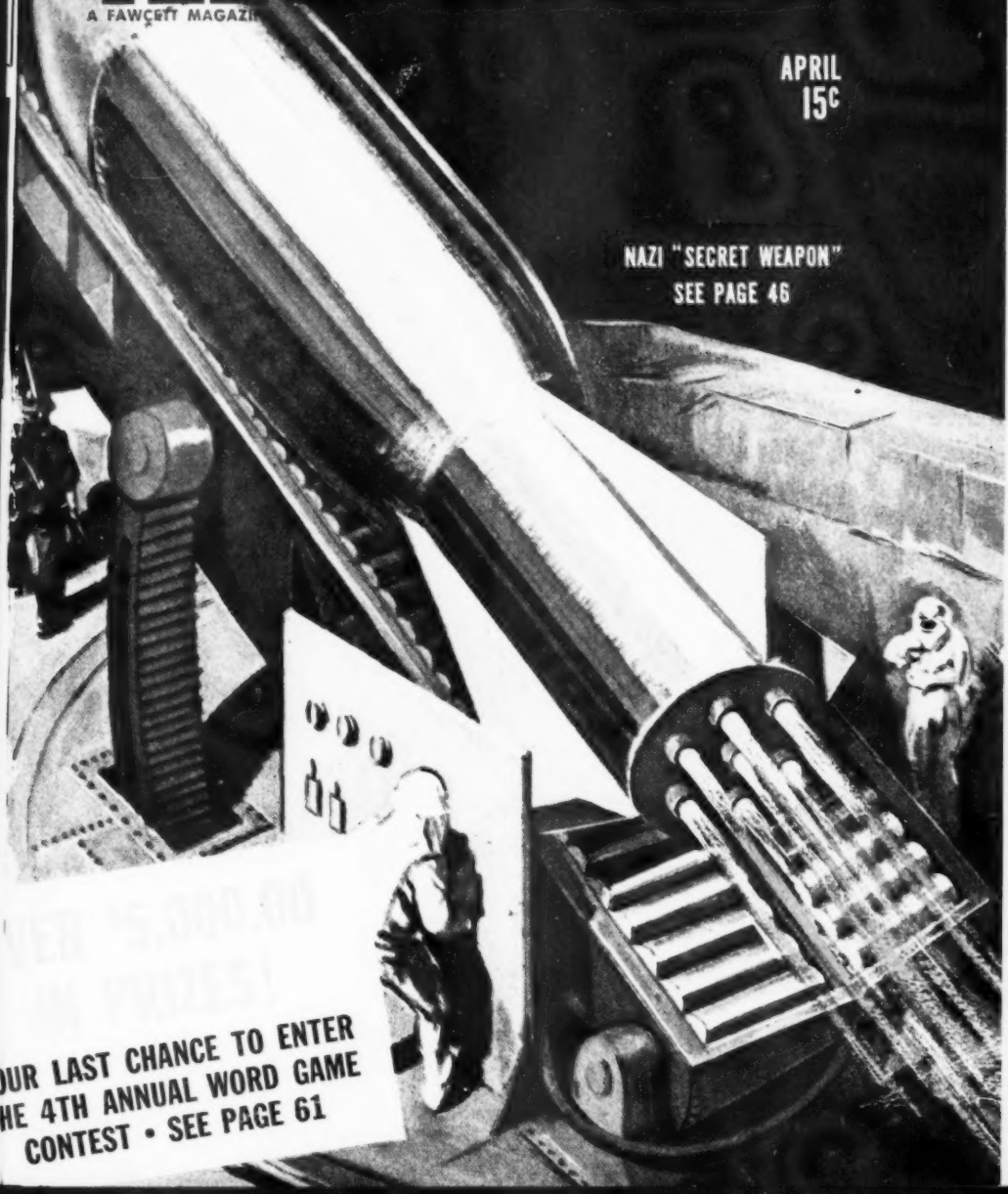
SEE PAGE 46



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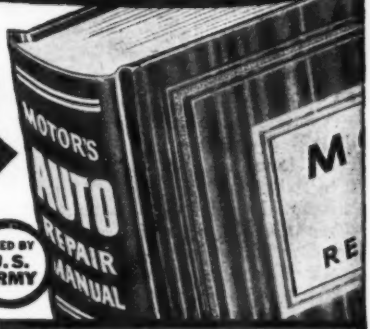

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YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

Metal Grinding Method

Tony C. Bertoglio, Lomita, California has developed a different method for grinding metal on an emery wheel.

ANSWER: *In accordance with our policy of not disclosing details of any invention we consider valuable we are withholding details of your system.*

It would seem that you have the germ of a good thought which might be suited particularly for grinding hard-tipped metal cutting tools. Even if the method does wear the wheel more rapidly, such wear must be expected because the tool is ground away faster.

We would recommend that you carry on a number of experiments using wheels of different composition. We would suggest that you have an immediate patent search made. If the search discloses a reasonable assurance of patent protection we would suggest such procedure.

After patent application has been made you should communicate with the leading manufacturers of grinding wheels. Notify them that you have applied for a patent and ask them to cooperate with you in the design of a cutting wheel which will stand up under the rigorous treatment.

There are two points on which you should assure yourself. Can you get as good a finished surface on the tool as you get on the ordinary wheel? Do you destroy the temper of the cutting edge? If the answer to the second question is affirmative then your method is good for rough grinding only but may still have commercial value.

Increasing Horsepower?

John H. Geiger, Los Angeles, Calif., asks if there is such a thing as a cone-shaped, variable speed, constant mesh gear. He also asks if a fluid drive unit, connected with a motor and turning at one-half speed of the motor doubles the horsepower at the driven shaft.

ANSWER: *Yes, there are constant mesh variable speed gears; several are made in cone-shaped combinations.*

There often is a mistaken impression of the meaning of the word—horsepower. Horsepower is an arbitrary unit for measuring work done by machines, etc., and is established as 33,000-foot pounds per minute. This means that a machine with a rating of one horsepower could raise a weight of one pound to a height of 33,000 feet in one minute; or 33,000 pounds could be lifted one foot in one minute; or 330 pounds could be lifted 100 feet in one minute.

In your proposition the fluid drive would produce two times as much torque (assuming there is no loss). The motor would pull twice the load but it would do so only over half the distance in the same time interval, or over the same distance in twice the time. This time factor is one with which many inventors fail to reckon. Regardless of what happens the horsepower remains the same.

Carburetor

Pvt. Malcolm E. McCan, Fort Bragg, North Carolina, states that in his experiments with gasoline he has come to the conclusion that the carburetor of the modern gas engine does not supply gasoline to the motor at its most combustible value. He has several plans for improving the design of carburetors and wants to know if we recommend further work along these lines. He also asks, "Is it true that carburetors have been invented to furnish a greater number of miles per gallon and then have been bought up by oil company and withheld from the market?"

ANSWER: *We feel positive that every automotive manufacturer would be interested in any carburetor which will give a greater number of miles per gallon of gasoline. It is assumed, of course, that the operation of the automobile will remain as flexible as it is today; that the carburetor will permit of quick starting, a rapid get-a-way and will operate in all kinds of weather.*

It is quite possible to thin a mixture in a modern carburetor to a point where the automobile will run at greater economy than the average car. But, if this is done by the mechanic, the owner of the car will find that its operation becomes sluggish.

We do not believe that any invention in any field has ever been purchased and buried to prevent its use by the public.

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MISS PRIORITY: Here she is—right out of June '43 MI. She, and another just like her, were built by Lt. F. E. Thomas, USN, of the U.S.S. Sperry at San Francisco, Cal., and he calls them real performers. A $5.00 Workbench award and a Certificate of Merit to Lt. Thomas.

Last Chance!

If you still haven't entered the big $5,000 word game contest that's been running in MECHANIX ILLUSTRATED since the February issue you'd better turn to page 61 and do it right now, because this is your last chance at one of the 100 prizes until 1945. Puzzle number 3 is printed on page 63, and you'll find the first two puzzles reprinted elsewhere in the magazine. So read the rules carefully and get busy. You have until April 15th to mail your entry, which ought to give you time enough to turn out a real First-Prize contender.

Machinist and Author

You readers who make a business or hobby of mechanics, machine work, tool grinding or just plain cellar workshopping will be interested to know that a real fellow-spirit is in your midst. Or more correctly, fellow-*spiritess*.

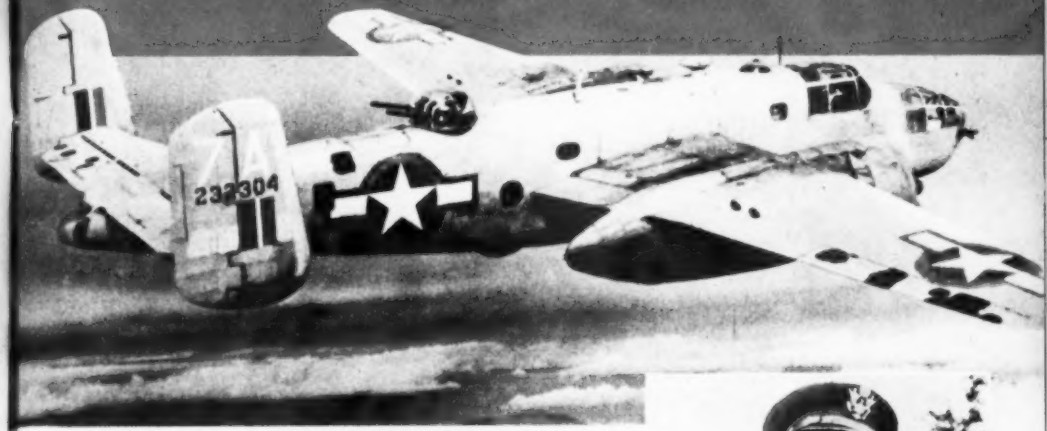
She's Josephine von Miklos, machine-minded ex-Viennese baroness, who would rather grind out a precision tool than fuss around a kitchen, though she's a good hand at whipping out a tasty dish on occasion, too. Lizzi (pronounced Leetzi), as she's known to her friends, has a beautiful little workshop in her New York apartment where she makes models of her industrial designs, tools, repairs equipment, etc.

Although writing, photography and industrial designing have largely occupied Lizzi's time professionally, she's always had a burning interest in things mechanical and when the war broke out she went first into a factory, then a shipyard, where she worked as a machinist in tool rooms, elbow to elbow with skeptical male veterans who soon became convinced that their feminine co-worker could keep up with the best of them.

Between shifts at the engine lathe Lizzi managed to find time to write her book "I Took A War Job," published by Simon & Schuster in 1943. Later she went to Hollywood as technical adviser in war work sequences of the forthcoming Selznick production "Since You Went Away." Back in New York now, she's engaged in post-war planning and designing, and figuring out new ways of making more people understand machines and enjoy working with them. One of these ways is writing for MECHANIX ILLUSTRATED; you'll find her first article, "Ten Commandments For The Workshop" on page 94 of this issue.

[*Continued on page* 155]

"ONE HIPPOPOTAMUS— TWO HIPPOPOTAMUS"



Tactical bombers fly their B-25 Mitchell medium bombers wing-tip to wing-tip, only five feet apart. At right, Lt. Eugene Wasserman, who piloted Mitchells in Tunisia, Sicily, Italy.

Whenever the bombardiers of the Tactical Bombing Force start counting hippopotami, get ready to duck. Each "hippopotamus" means another anti-personnel bomb deposited on the enemy's ground troops by these specialized bombers, whose job is to make medium, level, and area attacks right on the battle line.

by

Lt. Eugene Wasserman, USAAF

as told to Michael Stern

THE target for the day was a German Light Infantry Division which was holding out on a five-mile stretch of hills just north of Enfidaville and south of Bou-Ficha in Tunisia.

Plastering front-line troops is a ticklish assignment for a tactical bomber. From the air all soldiers look alike and should the bombardier be more than a fraction off mark, or should there be a slip-up in the highly complicated and secret code between the infantry and TBF (Tactical Bombing Force), then our own men, rather than the enemy's, would feel the weight of the bombs.

I strapped myself in the armored seat behind the stick of the medium Mitchell bomber, watched the other twin-motor ships in our flight soar up. The take-off is always a tense moment and I was jumpy as I waited for the signal.

It came and three of us, lined up wing-tip to wing-tip, roared down the runway together. We gathered over the field and fell into formation. My ship—it was named Dumbo and had a picture of Disney's flying elephant carrying a bomb in its trunk instead of a feather—was tail-end Charlie in the Avenger Group's right hand box. It was loaded with forty-eight hundred pounds of explosives divided into sixteen three-hundred-pound bombs.

It was late in the afternoon of May 12th,

1943, and the slanting rays of the sun threw long shadows on the beaches that ringed Hammamet Bay. We flew in boxes of six, maintaining a distance of five feet between wing-tips. Because troops were our objective we had twelve-inch AP (anti-personnel) sticks fitted into the bomb detonators so they would explode above the ground. This changed ordinary demolition bombs into murderous anti-personnel ones.

At briefing we were given the code for the day and told that our infantry would use yellow smoke to mark the line between armies. At the same time our twenty-five pounders would lob shells into the area that required most attention.

It was a beautiful day with just a few wisps of white clouds in a limitless blue sky. We cruised at ten thousand feet and banked left above Enfidaville. The dark hills below looked quiet and peaceful. I peered down through the plexi-glass windshield of the ship. I couldn't see a single sign of the enemy. He must have figured that if he kept quiet we wouldn't know where he was and would perhaps go away because he didn't throw any ack-ack at us.

Suddenly a long, thin line of yellow smoke cut a rough ellipse around a wide area. It wasn't a continuous line, but there were enough strands to it to completely set off the section upon which we were to drop our calling cards.

The number one ship levelled off and began an east to west run along the length of the ellipse.

The bombardiers in the lead group began their work the instant they crossed over the yellow line. In a loud voice they began to count: "Toggle one—toggle two—toggle three."

There was a one second interval between toggles and each time the number was called a bombardier flicked his finger on a toggle switch which resembles the electric switch on the wall in your home. Each toggle released a single bomb.

The bombardiers in the second bank of boxes withheld their fire until they counted the sixth bomb falling away from the lead group. Then they began toggling at one second intervals. Our ships carry no mechanical devices for counting off the seconds, the bombardiers doing it by voice. Some of the boys prefer to make their count by calling off "one hippopotamus, two hippopotamus" and so on because there is more danger, under stress of great excitement, of crowding

eighteen toggles into five seconds than there would be of jamming together eighteen hippos.

The lead box dropped its final bombs just past the center of the bombing area. The second box had twelve of its bombs away and the third box had six bombs away when we began to toggle.

Far below, grey-black blossoms of smoke flowered on the innocent-looking landscape. From the air it made a graphic picture of the deadly pattern we drew; one that covered every inch of the ring inside the yellow smoke, thin around the edges but so heavy in the center that no troops anywhere in the world could stand up under it.

We banked left and headed for our home base. I noted in my log book that our bombs dropped at 1830. Once the bombs were away all the tension dissipated. We were a pack of happy-go-lucky school boys again.

We made a perfect landing on the Sfax airfield. As I dropped through the escape hatch the head of my ground crew came running toward me. There was a broad grin on his face.

When the tactical bombers get through dropping their patterns, this is what the target looks like—blasted over every square inch.

"Congratulations," he said. "You just won the war."

"Quit your kidding."

"No. I mean it. We just got it on the radio. The Krauts gave up at 1845."

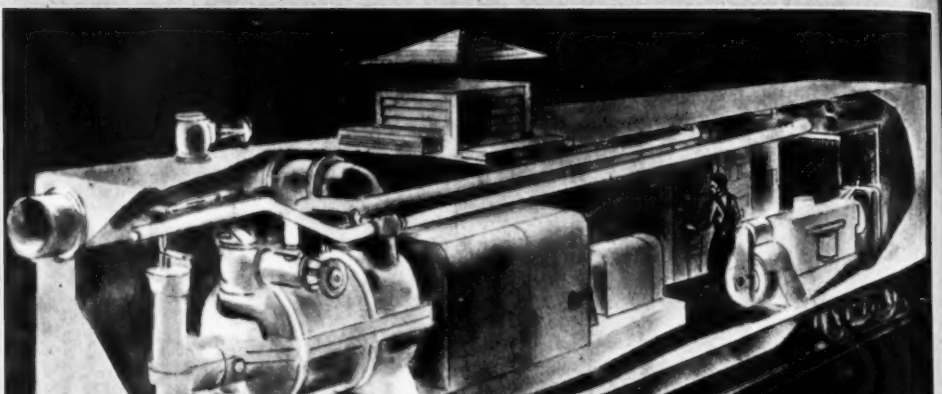
I wouldn't want anyone to get the idea that the ground crew felt our squadron won a war single-handed. What the mechanic meant was that our bombing had brought on the surrender of the last German unit on North African soil.

Tactical bombing is inclined to be more spectacular than the strategic kind. The reason for this is that its work is done on the battle line where the results are immediate. The Avenger Group is a tactical bombing unit. It makes medium, level, and area attacks. It differs from most other types of bombing in that it drops its load in a geometric pattern. The pattern changes its lines with differing targets.

On August 8th, the Avengers were called on to work on another major type of TB target. The American Seventh and the British Eighth Armies were crowding the Germans into the northeast corner of Sicily when they bumped up against the enemy's powerful Mt. Etna line. The keystone of the Nazi defenses here was the city of Randazzo, a large road junction through which flowed most of the enemy supplies and reinforcements. Our job was to create a road block that would paralyze traffic.

We took off at 1345 from an airdrome near Comiso, Sicily. There were twelve Mitchells arranged in two boxes of six, carrying three one-thousand-pound bombs and eight three-hundred pounders. We got into formation, made altitude and, planes bunched closely together, flew on a direct line toward our objective. This was going to be a tough job because the Germans had concentrated an enormous amount of anti-aircraft artillery to protect the base.

We crossed the enemy lines. My palms were wet with sweat as they gripped the stick. Ack-ack blossomed in the sky about us. We drew closer and it grew thicker. Staff Sergeant [*Continued on page* 147]



POWERHOUSE ON WHEELS

This sleek eight-car train is a roving power plant, equipped with boiler cars, condenser units, and steam-run turbine.

BOMB-TORN cities wrested from the Axis will be getting all the power they need from these mobile plants now being turned out by Westinghouse in preparation for the big invasion push. One of these rolling powerhouse units, complete from vaporizing equipment to windmill -like turbine, can work up 5,000 kilowatts of electricity, enough to supply a town of 10,000 people or run a large-scale factory. On the heels of the advancing troops, before the smoke of battle has cleared, one of these plants can be brought up and put into operation pinch-hitting for wrecked power installations. Ordinarily it would take from nine months to two years to get a bombed or sabotaged power plant running again.

CYCLES PREDICT THE FUTURE

by Donald G. Cooley

This is the third of a series of articles by Donald G. Cooley describing the manner in which Science is learning to foretell the future through the study of cycles. Next month Mr. Cooley will tell in further detail how you may learn to plan your own daily life through a knowledge of the earth's rhythms.

NEW YORKERS, in the days when there was plenty of gas for Sunday driving, said bitter things about the weather when rain fell on eleven successive week-ends.

They might have expected it!

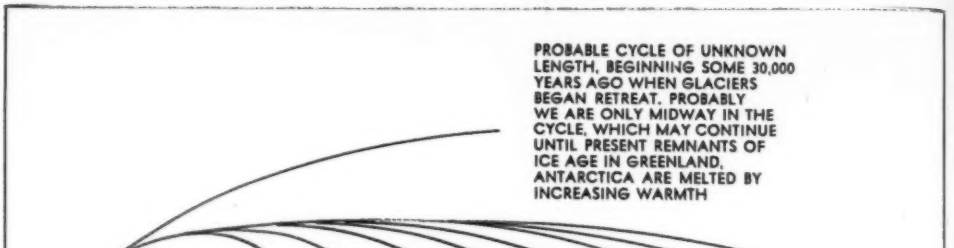
A weather cycle of approximately seven days is common enough along the North Atlantic coast. If it rains on Sunday, there's a good chance that it will rain again about a week later.

What Prof. Ellsworth Huntington, noted Yale climatologist, calls typical New England weather follows a cycle like this: a day or two of clear weather, then a day or two partly cloudy, next a cloudy day with or without rain, and finally another cloudy day during which rain falls. Then it clears and the cycle repeats. So, if Friday is a rainy day, you can be fairly confident that Sunday will be bright and dry enough for a picnic—if you live in New England.

Your local weather cycles may be quite different. Note on a calendar, day by day, weather conditions that occur in your locality over a period of months. Weather tends to repeat itself. Can you discern, from your records, weather patterns that repeat at fairly regular time intervals? Try it: you'll be delving into a fascinating field of cycle study, and you'll begin to acquire a certain long-term weather wisdom that may even be put to practical use, as in deciding which of two possible vacation periods will likely be blessed with sunny weather.

Weather doesn't just happen. If we knew *all* the laws governing its pulsations—the rhythms of cold to hot, of dry to wet—we

A rise in temperature of only 2 degrees would be sufficient to melt all polar ice. This would raise the world's sea levels 150 ft.—enough to inundate Manhattan Island with a shallow sea, put sea bass in Pennsylvania.


PROBABLE CYCLE OF UNKNOWN LENGTH, BEGINNING SOME 30,000 YEARS AGO WHEN GLACIERS BEGAN RETREAT. PROBABLY WE ARE ONLY MIDWAY IN THE CYCLE, WHICH MAY CONTINUE UNTIL PRESENT REMNANTS OF ICE AGE IN GREENLAND, ANTARCTICA ARE MELTED BY INCREASING WARMTH
DIURNAL CYCLE (DAY TO NIGHT)
ANNUAL CYCLE OF SEASONS
5½-YEAR "UP" OR "DOWN" PHASE OF SUNSPOT CYCLE
11.3-YEAR AVERAGE SUNSPOT CYCLE
23-YEAR MASTER CYCLE IN WHICH WEATHER TENDS TO REPEAT ITSELF
46-YEAR CYCLE ESPECIALLY IMPORTANT TO RAINFALL
170-YEAR CYCLE COMPLETING CLIMATIC CHANGES CHARACTERISTIC OF SEASONS: COLD-DRY, WARM-WET, WARM-DRY, COLD-WET
510-YEAR INTENSIFICATION OF 170-YEAR CYCLE
1,020-YEAR—THESE 3 CYCLES DUE TO COINCIDENCE IN 1980 BRINGING INTENSE COLD PERIOD
2,000-YEAR CYCLE OF GLACIAL ADVANCE AND RECESSION

A few of the many weather and climatic cycles in which we are now living. Effect of cycles within cycles, intensifying or minimizing each other. Shows complexity of cycle prediction in other than long terms. Establishment of more weather stations, measurements of radiation getting at cause of solar cycles, is showing the way. Some weather cycles are not shown.

could be reasonably infallible in predicting conditions on our planet years ahead.

The science of cycle study has made scarcely more than a beginning in the discovery of those laws, but long-range weather forecasts are already here. General H. H. Arnold, chief of the Army Air Forces, reveals that weather forecasts 10 to 30 days ahead are now sufficiently accurate to be used regularly in planning military operations.

Is a bombing raid planned on a Jap target in China? Our fliers know the days when fog may be helpful or hazardous, and the hours of the day when thunderstorms are likely to occur. Before a raid is planned on a German city, weather records which may go back 50 years are studied. Swift sorting machines select old weather maps recording conditions identical with today's weather. The key map may be for 1923, or 1898, or 1912. Then succeeding maps are studied to find out how that weather of twenty or forty years ago developed. It is likely to follow the same course tomorrow and the day after in that particular German city, and plans are made accordingly.

This is different from conventional forecasting in which existing storms and atmospheric pressures are studied. It is prediction on the basis of what happened fifty years ago—in short, it makes use of cycles, the habit weather has of repeating itself.

If there were only one or two cycles affecting weather, the problem of prediction would be childishly simple. Instead of one cycle, however, there are unknown numbers of various duration intensifying and minimizing each other. As Dr. E. E. Free described it, it is as if a dozen clocks were ticking at once. Each clock has its regular rhythm; the problem is to separate the medley of ticks and ascribe each rhythm to its own clock.

The dust-to-dust cycle of human life is so brief that we naturally think of ourselves as living in a world of stable climate. Actually, the same relentless climatic cycles are running their courses along with us that have changed the face of the earth over millions of years. Suppose we examine a mere dozen of the

well-defined weather cycles science has identified, ranging in length from 24 hours to 2,000 years.

We can more readily realize that we are living in a complex of cycles if we begin with a short one easy to recognize. This is the diurnal, day-to-night cycle. Some of its characteristics differ with localities, but these are features of a common pattern: clouds tend to diminish toward evening, winds to die down during the night, temperatures to reach a peak a couple of hours after mid-day, heat thunderstorms to occur in the afternoon. Such recurrences as these you have probably observed without thinking of them as cycles. Yet the definition is fulfilled, a cycle comprising anything which tends to repeat itself in a regular rhythm or period—and which therefore gives us an extraordinarily accurate method of prediction.

You have of course noted the cycle of the seasons. But note the *kind* of weather typical of seasons: midwinter is cold-dry; spring and early summer, warm-wet; late summer, warm-dry; fall and early winter, cold-wet. Occurring annually, these cycles are part of instinctive human knowledge.

Now we come to a discovery which is startling merely because it transcends the span of human life. Changes in *world climate* follow the same rhythm *as the seasons.* That is, world weather in general begins cold-dry, advances to warm-wet, then warm-dry, and finally cold-wet, whereupon the cycle repeats. But instead of a yearly seasonal shift, the cycle is *170 years* long.

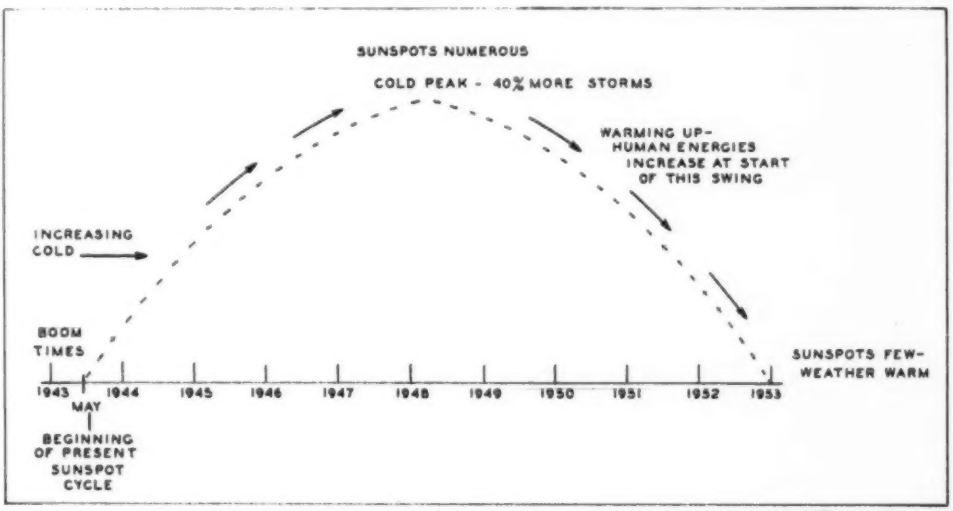
This pattern of world climate has been established by Dr. Raymond H. Wheeler of the University of Kansas in the most elaborate cycle study yet undertaken (see MECHANIX ILLUSTRATED, February). His "drought clock," going back to 450 A.D. and based upon tens of thousands of weather items through the centuries also reveals that every third cycle, or 510 years, is intensified. He finds also considerable evidence of a 1,020 year cycle.

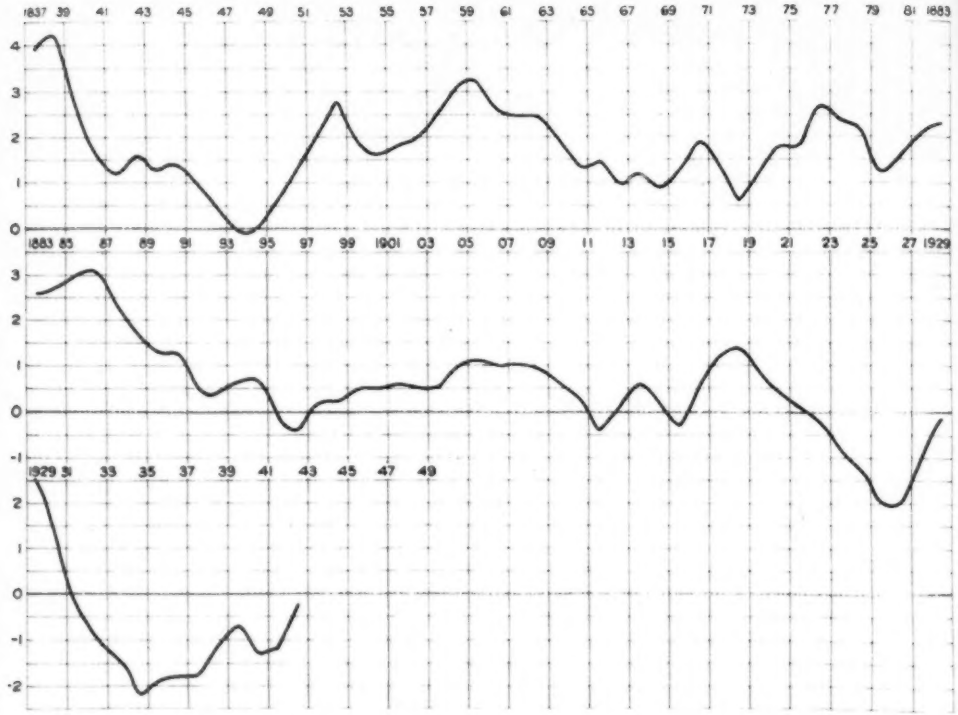
When all these cycles come together, the effect is to blend the ticks of separate clocks into a tremendous roar. Will they coincide during our lifetime? Yes, some readers of this magazine will surely be alive in 1980. Around that year these cycles will intensify each other and the result should be one of the most intensely cold periods in human history.

Where are we now? We have recently moved out of the warm-dry phase (the late summer of the cycle), terminating a warm period which has lasted since the Spanish-American war. Remember the Dust Bowl droughts and the Okies? This hot drought period has throughout history been a typical windup as the world moves onward to colder times.

Now that your mind is adjusted to the idea

This is a conventionalized pattern of a typical sunspot pattern. The average length is 11.3 years, but present sunspot changes are among the fastest on record. This is typical when going into longer intervals of cold. Our present sunspot cycle may thus be considerably shorter than the average. As you will note, 1948 will be no year to build a vacation sailboat.





The level of Lake Huron, 1837-1941 inclusive. The general similarity of the two top completed charts is obvious. These are 46 year cycles. Note great depressions after 1837, 1885, 1929, and lesser ones 23 years after each of the first two. Bottom chart already shows a running to true cycle form. Most variations are due to cycle-within-cycle effects.

of a 1,020 year cycle, we are ready for the next jump of 2,000 years. Every schoolboy knows that the continent once was covered by an ice sheet which extended well south into what is now the United States. About 30,000 years ago the world began to get warmer. The colossal ice-cap started to melt along its leading edge. It withdrew northward, but in no steady retreat. No cave-man of the time, clad in a saber-tooth tiger pelt, could have thought otherwise than that the glacier was eternally fixed—he could have detected no motion, and he would have been as oblivious to the cycle he lived in as most of us are today.

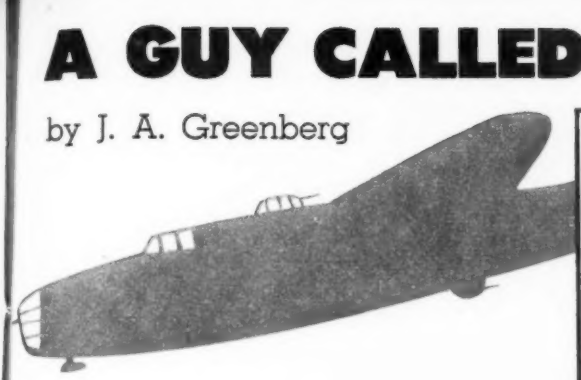
For the glacial retreat *was* cyclical. One could better say, *is* cyclical. The ice cap would retreat for 1,000 years; the next thousand years it would hold its own, perhaps advance. Thus the cycle of recession was about 2,000 years long. The records of retreat and advance are written in moraines and varves (the latter being alternating layers of clay and sand laid down by melting waters that were quiet in cool times but roaring floods when the world warmed) that are clear enough for geologists to read.

It is highly probable that we are still living in the Ice Age that most of us think is past and done with. Before the latest ice sheet began its retreat, at least three others came and went. Extending the cycle chart some millions of years, we see that Ice Ages are themselves cyclical in recent geologic time. If the present 2,000 year cycle of recession is near its end—a mere assumption—then it began at the time of the star of Bethlehem!

We may well be near the middle of an ice age cycle which, beginning its warm phase some 30,000 years ago, has about as many years to run before the world turns cold and ice again starts flowing from polar regions. The continental ice sheet still covers Greenland and Antarctica. Coal deposits give clear indication that polar areas once enjoyed tropical climates. As recently as the tenth century, Norse settlers in Greenland were able to bury their [*Continued on page* 140]

A GUY CALLED ED

by J. A. Greenberg



Do you know Ed Wells? He almost had his heart broken when his brainchild, the original Flying Fort, crashed, but persevered to design the B-29, gigantic super-fortress of the Allies.

HE'S so shy and retiring that hardly anyone will realize he's at a party till it's breaking up. Then it is usually discovered that he has been sitting quietly in a corner with his wife, nursing a drink to be sociable, though he isn't a drinker. This modest fellow is the man most responsible for one of the outstanding weapons of this war, the Flying Fortress, about whose achievements of destruction you have been reading these many months.

His name is Edward Curtiss Wells, but he is more comfortable as just plain Ed Wells. At 34 he is chief engineer of the Boeing Aircraft Company, makers of the Flying Fortresses. Quiet and reticent, talking, dressing and acting conservatively, he is, in his outward aspect, so much the average man that you'd never think of picking him out of a crowd. He rarely appears in public, never makes speeches, and it is almost impossible to prod him into talking about his role in the creation of the Flying Fortress.

The Lawrence Sperry Award of $250 is given annually to a young man for a notable contribution to the advancement of aeronautics. When it was conferred on Edward Curtiss Wells in 1942 "for outstanding contributions to the art of airplane design with special reference to four-engined aircraft," he was completely unknown outside the Boeing organization, though his contributions had radically altered the nature of aerial bombing. General "Hap" Arnold had called the Flying Fortress "the guts and backbone of our world-wide air offensive," yet only the few who had worked with Wells realized his stature. He had been then, since 1939, assistant chief engineer, but to the thousands of workers at Boeing he was just a pleasant guy called Ed.

But if he is colorless and unimpressive in appearance and deportment, Ed Wells is a sparkling demon over a drawing board. Called into an engineering conference to iron out a baffling problem in design, he listens intently in his quiet way, without making any comment. Asked for an opinion, he replies that his knowledge is still insufficient.

He digs in, concentrating on the problem, until suddenly he grabs a pencil and swings into feverish action. His whole aspect changes. He is a flashing meteor, a brilliant comet throwing off sparks as his pencil races over the drawing board. The lines assume form and continuity and, presto, there is the problem resolved, with luminous originality. The group of engineers stand speechless, mouths agape, hypnotized by the brilliance of the solution.

Born in Boise, Idaho, in 1910, he was raised in Portland, Oregon, where his father was the government meteorologist. A typical American boy, he had a newspaper route after school and worked out his summers in the service department of an automobile accessory dealer. At ten he was whittling his first scale model of a Jenny training plane, and by freshman year in high school he had fashioned

a model flying boat powered by a strong rubber band. His engineering was good even then.

The same automobile dealer provided employment during Ed's two years at Willamette University in nearby Salem. Then he entered the engineering school at Leland Stanford University, graduating at the head of his class in 1931. Always a fellow to look a little bit ahead, he had lined up a job before graduation, but, sheepskin in hand, he discovered that his much-coveted job had been wiped out by the depression.

After weeks of futile job hunting, despair almost swept him into the lost generation of the 30's when a letter informed him that a change of plans had created an opening at Boeing, where he had worked several summers.

His superiors were impressed by his initial job of detail drawing on the empennage of the famous Boeing 247, first of the twin-engined, three-mile-a-minute transports, but he was almost lost to aviation the following year when a Detroit automobile factory offered him more money than he was getting. He debated the offer carefully and conservatively, and then wrote out his resignation. After a night of restless tossing, he was waiting impatiently early the next morning for the Boeing office to open so he could withdraw the resignation.

Subsequently, he worked on the preliminary designing for the controls, landing gear and tail surfaces of the P-26, long the Army's standard monoplane pursuit, and the XP-940, a faster fighter notable for the elimination of wires and struts.

Ed Wells had made his mark by that time. At twenty-four he was assistant project engineer of Boeing's Project 299, from which burgeoned the Flying Fortress. Project 299 crashed in dismal failure on the flying field at Dayton, Ohio, the victim of inadvertent negligence, but Ed Wells' genius and engineering skill persisted during eight years of discouragement and detraction in making changes and innovations till the Flying Fortress was finally accepted by the Army. Its achievements are today familiar to every newspaper reader. The story of the Flying Fortress is one of the epic sagas of aeronautics.

Boeing had decided in 1934 to enter an Army competition for a new bomber for which "multi-engines" were specified. Bombers then had twin engines and the Boeing staff was certain that the Army engineers had had such a plane in mind when the specifications were written. That was in the depth of the depression which had given the airplane companies an awful beating. Success in the competition was so important that the Boeing management decided to risk all its resources in the development of a new bomber startlingly revolutionary in design, power and performance.

Claire Egtvedt, then chief engineer and now chairman of the company, recalled a conversation in which Admiral Joseph Reeves had held that the battleship was "the only sea-going weapon which could deliver the knockout blow by carrying thousands of pounds of

Here's the "Knockout Dropper," first Flying Fort to fly 50 missions over Europe. Still going strong, the big ship has completed 300 combat hours, dropped 225,000 pounds of bombs.

destruction thousands of miles and pouring it on an enemy target." The Admiral had added that no aircraft could accomplish that feat. After much consultation, the Boeing engineers decided to build just such a battleship of the air, whose four engines and great carrying capacity would far outstrip competitors in range, speed and striking power.

That was the job put in young Ed Wells' lap, and he was to be married just about that time. The ceremony took place on Saturday, the honeymoon lasted through Monday, and then he practically passed out of his bride's life for a month, for he and his associates had the seemingly impossible assignment of designing, engineering, building and testing a completely new plane in twelve months.

During the next month, all the basic elements of the Flying Fortress were conceived and designed, including such unusual innovations as a sound-proofed and heated cabin and heavy guns fired from turrets. Every obstruction to air flow was eliminated to make the plane "clean" aerodynamically. The Flying Fortress still has those same basic characteristics which have since been adopted by the leading bombers of every other nation.

The pressure of time was so great that the entire staff worked on the acres of detail drawings for construction before the normal wind-tunnel tests were made. Young Ed and his associates conceived so sound a plane that, when the wind-tunnel tests were made after the detail design was well under way, not a single major change was necessary. Then a small army of engineering specialists was organized into units, each with a specific task, and blue prints were fed into the factory.

Ten months after the project was started, model 299 was rolled out on the field and turned over to the flight test unit for a month and a half of shaking down. It was flown non-stop from Seattle to Dayton, establishing a world record for the distance.

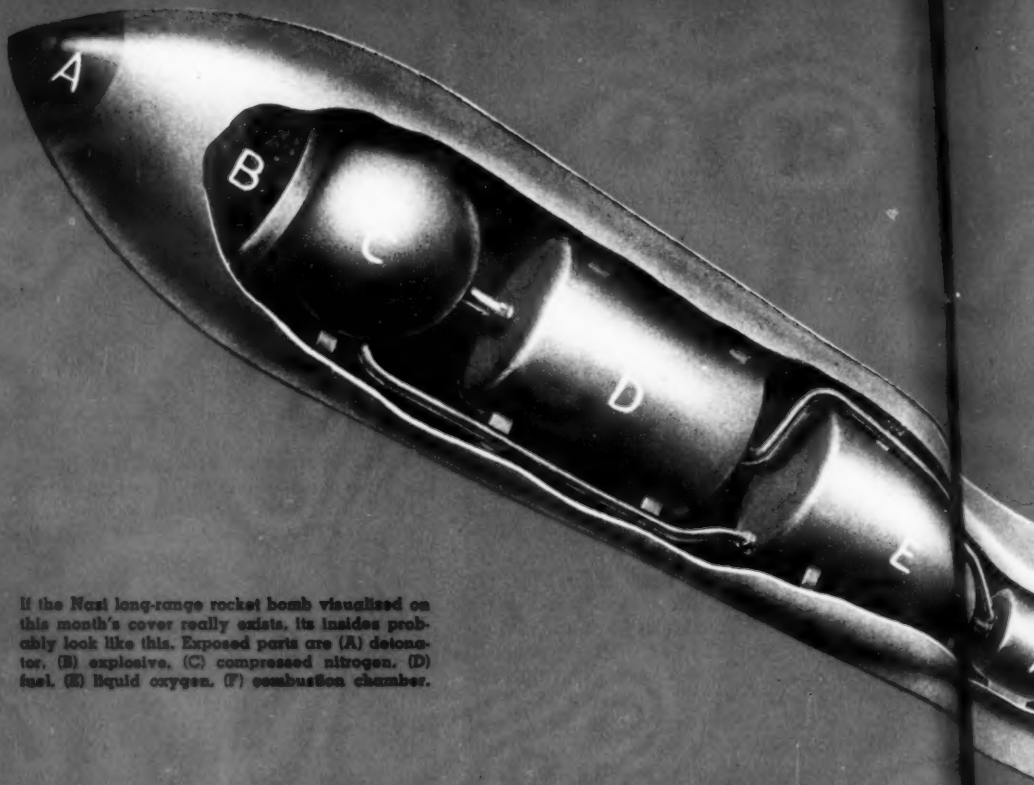
Two other manufacturers had also entered planes and the Army tested the machines for a month. The performance of Project 299 gladdened the hearts of its creators; its adoption by the Army seemed certain. Then one sunny afternoon, Ed Wells watched from the edge of the field as 299 took off in a steep climb, stalled, turned on a wing and crashed from 200 feet. The pilot had inadvertently taken off with his controls locked. Boeing's gamble was lost through an accident of carelessness.

Young Wells was sickened and horrified. Les Tower, his friend and Boeing's chief test pilot, had been in the plane as an observer.

It looked like the four-engined bomber was doomed. One of the other competitors was given an order for several hundred aircraft, and Boeing was consoled with an order of thirteen 299s plus an additional one for destruction tests.

While these aircraft were being built, young Wells and his associates conjured up a new major sensation. The fourteenth plane, originally to have been destroyed in structural tests, was saved for a flying laboratory. Four bulky super-chargers, each half the size of an engine, were worked into the crowded wings and the problem of handling the red-hot blast of exhaust gases used to spin the turbines was mastered. The result was the first successful turbo-supercharger plane, with its speed at high levels exceeding that of light pursuit planes and its ceiling raised from four miles to more than seven.

Despite its [*Continued on page* 160]



If the Nazi long-range rocket bomb visualized on this month's cover really exists, its insides probably look like this. Exposed parts are (A) detonator, (B) explosive, (C) compressed nitrogen, (D) fuel, (E) liquid oxygen, (F) combustion chamber.

SECRET WEAPONS

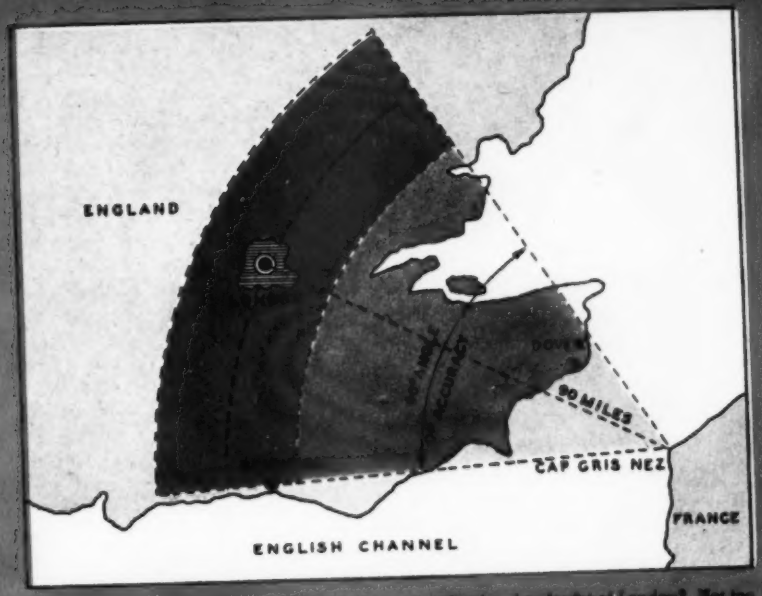
by Major Malcolm Wheeler-Nicholson

"Our new weapons," says Admiral W. H. P. Blandy, "can be and are kept secret, except that the enemy receives full knowledge of their effects." Here, in a sober analysis, MI's military analyst debunks the Herrenvolk's "secret weapon" scare.

OUT of the rumor factories of Stockholm, Bern, and Berlin come periodic threats of miracle-working Nazi "secret weapons" that will blast the Allies sky high and clinch the war overnight. Are they sheer bluff?

As this is being written, a hullabaloo is still raging in the press over the much-touted German "rocket bomb." Dr. Goebbels himself, fanning the propaganda flames, has claimed that a whole British convoy was wiped out in the English Channel in a matter of minutes by murderous long-range rocket shells. He would have us believe that the entire North French coast is a solid mass of rocket batteries capable of lobbing 12-ton bombs over London, each one powerful enough to devastate 20 square miles.

There's plenty of reason to believe that Nazi spokesmen are waging a desperate war of nerves with their flamboyant threats to pound Britain with screeching town-busters. Rockets just aren't that



Cross-channel rocket bombardment of London? Not too likely. Long-range rockets are notoriously inaccurate. might miss their mark by 30 degrees either way. Bombs aimed at London might whiz over Brighton or Dover.

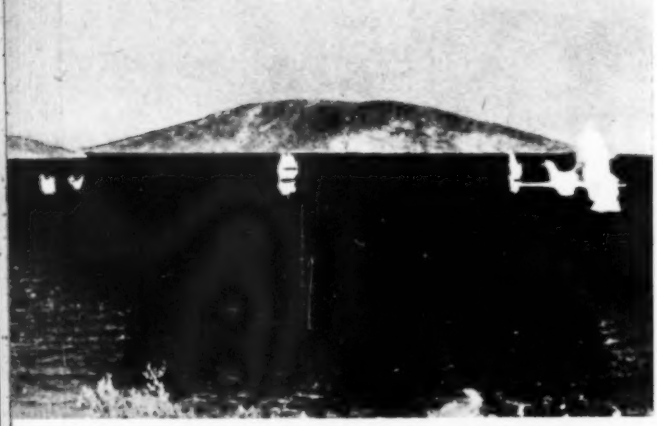
FRED RIPPERDA

good. For one thing, they're far less accurate than missiles from rifles or even smoothbore guns. What's more, they would have to carry so much fuel on long-distance flights that their explosive load wouldn't be greater than that of an Allied blockbuster. The Germans may very well have some surprise up their sleeves. But the high-powered rocket scare certainly means that Hitler's General Staff has abandoned all hope of renewing its aerial blitz or landing troops on Dover Beach.

As against scare headlines, Allied military experts can set up some reassuring facts. Previous German efforts to profit by secret devices of warfare usually proved to be dismal duds. In addition there is the undeniable circumstance that secret weapons sometimes influence local decisions but never win wars. From the burning glasses of Archimedes, which set fire to Roman galleys in ancient Sicily, to the Nazi acoustic torpedos which attempt to track down not-so-helpless Allied merchantmen in the Atlantic, secret weapons have been tactical and local in their effect rather than strategic and general.

Further, the combined Allied scientific staffs, in number and ability of scientists and amount of research facilities, outweigh by far their German equivalents. The best of the German scientists have been exiled or sent to concentration camps. And Allied, especially American, production facilities are so flexible and can so quickly be geared up for the mass production of counter weapons, that any new enemy weapon would have shortlived success.

Above is the only released picture of the new Nazi "Hummel-Hummel" gun, nicknamed the "Bumblebee" by the British. This battery is supposedly installed on the southeast Balkan coast.



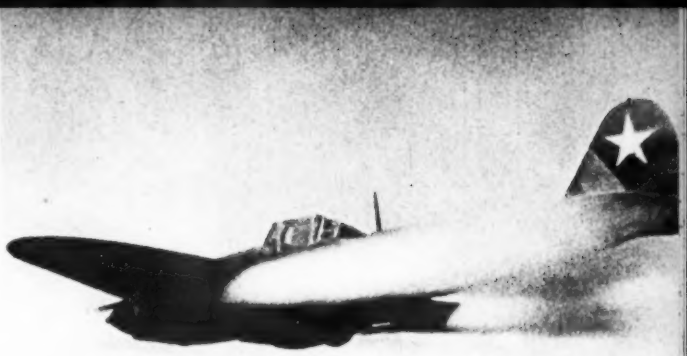
The "super-surface torpedo" launched by the "Bumblebee" skims along at water level, ricocheting across the waves. Supposed to carry a devastating explosive, it hasn't fazed the Allies.

We've heard this kind of extravagant talk before. There seems to be some enormous blind spot in the square Teutonic head that makes Jerry a sucker for war predictions partaking of fantasy. The German wants fervently to believe that some mechanical miracle will turn up momentarily to retrieve his strategical and psychological errors.

In the last war, the Germans let loose with U-boat wolf packs, poison gas, Big Berthas to shell Paris. But they still lost the war. One Allied "secret weapon"—the tank, which ploughed down barbed wire entanglements, trenches, and machine gun nests—did more damage than all the German tricks put together. "It was not the genius of Marshal Foch that defeated us," wrote German General von Zwehl in 1921, "but that of General Tank."

It is worth remembering that Allied scientists are not exactly idle in this war. We may not do as much lung work as

Goebbels and his cohorts, but our laboratories are working overtime, and we've already sprung a few surprises in the ordnance field that set the Germans back on their heels. Vice Admiral Thomas Curteis, senior officer of the British Navy in the Western Atlantic, said recently that "The Germans may have something very violent up their sleeves but I think I can safely say that whatever they produce, it won't make the slightest difference to the war: we'll get over it." In short: our scientists have enough know-how to cope with any emergency.



The Germans aren't the only ones who know how to launch rockets. The Russians are old hands at it. Here is a Stormavik plane unleashing its rocket bombs on some German tanks.

Admiral Ingram C. Sowell of the U. S. Navy, speaking in the same vein, announced not long ago that "Secret Allied weapons have been responsible for our lop-sided victory over the Japanese in the Pacific." Among the "ordnance sensations" disclosed by him and other military spokesmen in answer to Nazi threats were: tremendous improvements in fire control on certain types of guns, making it necessary only to sight on a moving target to get perfect aim through mechanical computations; a device for jumping the top speed of fighter planes by pumping water directly into their engine cylinders along with gasoline. And now the Allies have their "piat projector," a one-man tank-buster whose vicious projectile will blast through four inches of the finest armor plate.

"Our new weapons," says Admiral W. H. P. Blandy, "can be and are kept secret, except that the enemy receives full knowledge of their effects."

The list of Allied secret weapons in this war —just those few that have so far come to light —puts to shame everything the Germans have been able to offer. The first surprise that Hitler sprang was not a mechanical contrivance but startling innovations in tactical formations—the tank-airplane team and lightning panzer divisions being the most notable. After reeling under initial blows, the Allies came back by developing strategical air power, outstripping Luftwaffe leaders who conceived of aviation only in the role of ground-troop support. Today the Allies dominate the skies, however stiff the opposition.

The Germans made much of their triple-purpose 88 mm. gun, which could be used for either anti-aircraft, anti-tank, or field artillery fire. Having smashed the "impregnable" Maginot Line with this effective weapon, whose projectile can pierce nearly three inches of armor at a distance of two miles, they turned it loose on the British Eighth Army in Africa, driving Montgomery back almost to Egypt. But the far superior, more mobile American 90 mm. smashed Rommel's 88's and drove him from El Alamein into the Tunisian sea. The Guerlich tapered-bore, high velocity, anti-tank gun proved no more decisive, since the Allies adopted counter measures long before there were enough of these guns in the field to count.

The Germans have no anti-tank weapon to match our bazooka—the absurdly simple one-man rocket gun that enables our soldiers to hold their ground against any enemy tank. The bazooka has already seen action with invasion troops, knocking out beach pill-boxes and blowing up barbed wire obstacles. The German tanks, which spearheaded the attacks of their crack panzer divisions, were good. But, after some initial fumbling, Allied assembly lines poured forth a mounting stream of General Shermans, Priests, and a whole variety of self-propelled guns that have no peers anywhere. We have the Sperry gun sight—a mechanical brain which does rapid-fire calculations and points a plane's machine gun [*Continued on page* 150]

"SWEATING IT OUT"

by Arch Whitehouse

MECHANIX ILLUSTRATED *European Correspondent*

Arch Whitehouse, at left, was permitted to sit in on one phase of a "briefing operation." He witnessed other "sweating out" periods that precede an American bombing operation over Europe. He tells you what it means to our fliers to get ready to remove Berlin.

THIS is what happens before those big bulky Liberators take off. This is what our bomber airmen say and do while they are "sweating out" a mission. To "sweat out" means to go through the hours of torment that bind cruel barbs about the men who are booked to go. They "sweat out" through the 3 a. m. breakfast and they "sweat out" through the cold, pitiless hour of briefing. They "sweat out" in the drying room where they complete their dressing before climbing into the fleet of trucks that rumble them off through the darkness to the dispersal bays. There is no modern inquisition quite equal to this and strangely enough, it is further intensified if for some reason the mission is "scrubbed" at the last minute. You scrub a mission when you wash it off the board—cancel it.

They "sweat out" because they know that a "scrubbed" mission still has to be completed.

This is being written in a cold dank cell only a few paces distant from the perimeter track of an Eighth Air Force bomber station. Outside, lean-flanked men slosh through the mud and slime in G.I. shoes and leather windbreakers. You can't tell a Colonel from a private, so indeterminate is their general garb. In this dreary room two pathetic ineffectual stoves vainly attempt to drive the penetrating chill to the dark corners and the breath of the men sprawled about produces vapor plumes. There are seven beds here, half a dozen foot lockers and a dreary drapery of trench coats, dirty towels, musette bags and odd socks. The smiles and grimaces of the pin-up girls clipped from Yank magazine might well be ads for cough syrup or fencing wire. It's a mess, but this is war—not Randolph Field. Some of the boys are still sleeping. Another is poking at the recalcitrant fire, offering advice over his shoulder to another trying to make an American electric razor cord fit into a British wall outlet. He doesn't know it, but he's in for a shock when it goes up under the smack of 220 volts instead of the 110 he expects.

A few minutes after dinner the Tannoy speakers all over the station (this is the R.A.F. field which was recently turned over to the Americans by the British, and it still has many of the British features, including the mud) scrawnched the warning of an "Alert." This meant that all air crews would stand by; that there was to be a mission in the morning.

In those words, repeated in a monotone, bubble up the initial froth of a hell's brew. It means that somewhere in Britain General Ira Eaker of the AAF and Air Marshal Sir Arthur Harris of the British Bomber Command have decided on a certain target outside Oslo. These

An Intelligence officer briefs a group of bomber airmen on the target for the day. The men grimly absorb the facts. Then—more sweating periods.

decisions are not reached willy-nilly or by sticking a pin blindly into a map. They are the result of weeks of study and intense military consideration. These raids are not planned primarily to destroy a certain target. Time and circumstance are paramount considerations. For instance, if a certain vital rail communication system can be destroyed a few hours before an expected mass movement is planned, the installation is not only put out of action but an important military move is frustrated. If it is destroyed some time before the enemy tactical program is planned, the enemy may have time to repair the damage.

You pick up all these points at the briefing. For the first time, you sense the keen finesse of battle maneuvers. All the complexity of it leaves you with a greater appreciation for Staff work and most certainly a deep respect for Intelligence.

To see the modern bomber command organization clicking leaves the ordinary man breathless. Once the target has been decided upon, all that remains to be done as far as this organization is concerned is to relay the target to the bomber groups selected to carry out the assignment. Their work has been done. It probably started, as far as this particular target is concerned, weeks before when some keen-eyed young Intelligence officer spotted a speck on a certain aerial photograph. From this point on, bomber command begins to "sweat out" a raid.

Let us for instance assume the target has been finally selected by Messrs. Eaker and Harris. This is flashed to the Air Division headquarters who in turn relay it on to the Group Commanders within their jurisdiction. Generally speaking, the target is known some hours before the loaded bombers roar away on the mission.

First, the Group Intelligence personnel take this target detail and look it up in their file. There in one bank of data they come upon an actual air photograph of the target. In the same folder will be found a number of photostatic reproductions of this particular area which are intended for distribution among the pilots and bombardiers.

In another folder will be found complete data and topographical details of the target and explanations of the area about it. Thus, the Intelligence men have full details of the objective at once. All this detail has been collected carefully for weeks and weeks. At briefing then, the crews will know just what it is they are setting out to destroy and its place in the military scheme of things. They

know exactly what it will look like from a certain height. They will have explained to them just what the surrounding territory will look like under most conditions—whether it be snowing, raining or under the glare of mid-day sunshine.

Once the target is known the Engineering officers are advised and the distances checked. On this information the planes are fuelled for a definite mission. They don't simply order the ground crews to fill the planes with gas and oil. The tanks receive enough fuel to take the plane to its destination and back with an additional allowance for normal emergency conditions. What available weight allowance is left can then be used for extra machine gun ammunition, additional crew members who might go along for experience, or perhaps the Flight Surgeon will decide to go along to check on a crew member who is complaining that he gets a type of muscular discomfort at certain altitudes.

There's a story in these heroic Flight Surgeons, too.

Once the nature of the target is known and the effect desired is explained, the Armament officers select the type of bombs to load, how many and how they should be fused. (The bombs dropped on Ploesti were armed and fused to explode from one to three hours after they were dropped.) The nature of the target, that is to say, the general structure of it, determines what type bombs are to be used and what classification of fusing. At the same time the gunnery officers and their men are swarming all over the big Liberators, checking guns, mountings, turrets and ammunition feed lines. Before the planes leave the gunners will go aboard and double-check all these points to their own satisfaction.

All this goes on out on the field where the bombers are nuzzling into their dispersal bays, while the air crews are getting their last few hours of sleep. It goes on amid the mud and slush with dim pin-points of flashlights providing the only faint beams of light. These men must have hands and fingers as sensitive as readers of Braille to carry out this work, night after night, with such dogged loyalty and skill.

But long before dawn the air crews are aroused and the Tannoy speaker sheep-dogs them down to breakfast. A pre-briefing breakfast is something to behold. It reminds one of some fantastic scene lighted by Hazzard Short where the characters wear putty-colored masks. The figures stumble on sleep-shackled limbs to the line-up and unconsciously pick up plates and hold them before them, passing the steaming platters of food. I joined this sleep-walking throng, mainly to hear the lines of a real briefing and discovered when I reached the end of the line that my plate held three fried eggs, a stack of golden brown French fried potatoes and several strips of bacon. There was all the coffee you could drink—and yet, somehow none of it had any taste or smell. My teeth were fuzzy and I couldn't swallow. You eat these goodies but you can't remember when you did it. No one speaks, no one asks a question or answers one. They reach blindly for sugar and cans of evaporated milk and perhaps someone else will pass a platter of bread, but there are no thanks or acknowledgements. You can hardly recognize the faces that were familiar to you the night before in the Officers' Club.

Like a drugged pack they move off and climb into the trucks again and we go to a Group headquarters building where the actual briefing takes place. Here the pilots, co-pilots, navigators and bombardiers are gathered in one room. This is strictly hush-hush and no kidding. I was allowed in only when I had shown my credentials once more and got the nod from a Colonel. In another room the gunners and flight engineers are being given a less comprehensive explanation of the mission, but they at least know what it is all about, where they are going and what to expect in the way of enemy fighter opposition every mile along the route. Certain other details are given also—just in case they are forced down. Once this is over they are rushed out to their aircraft to begin their gunnery and engineer checks.

In the main briefing room, the Group Intelligence officer took a low platform to give the general outline and objective of the raid. As they passed in, the airmen were given their maps, photographs and typed data on the trip and the target. There are great blackboards on each side of a silver screen, and on these have been chalked the take-off time, the estimated time of arrival over the target and the rallying time after they have all dropped their loads. It is all cruelly mathematical, everything is planned to the minute and one gets the full impact of this terrible timetable when the Colonel explains that barring the unforeseen, they should be opening their bomb doors at such-and-such a time and rallying for the return a few minutes later. In the same breath, however, he adds instructions as to the [*Continued on page* 145]

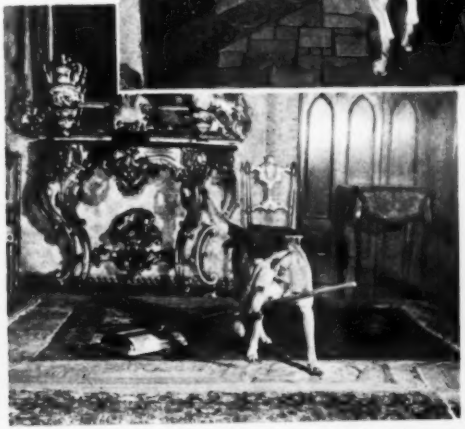
CANINE BUTLER

Look at that face! Cookie enjoys taking his Peke charges out. Gentle at home, he becomes formidable when made a custodian.

COOKIE has replaced Jeeves for the duration—and maybe for good. Cookie is a German Shepherd in the employ of Mrs. Sol Goldberg of Chicago. He is the perfect servant, carrying his sense of responsibility toward his duties as an honored member of his family and yet maintaining his place. As a housecleaner, pet attender, maid, it would be tough to find his equal.

There's that mess a fallen ash tray made. Three-year-old Cookie (at right) opens the closet door and pulls out the carpet sweeper.

Bed-making is a man's job in this man's army now. Our canine butler keeps proudly abreast of the times.

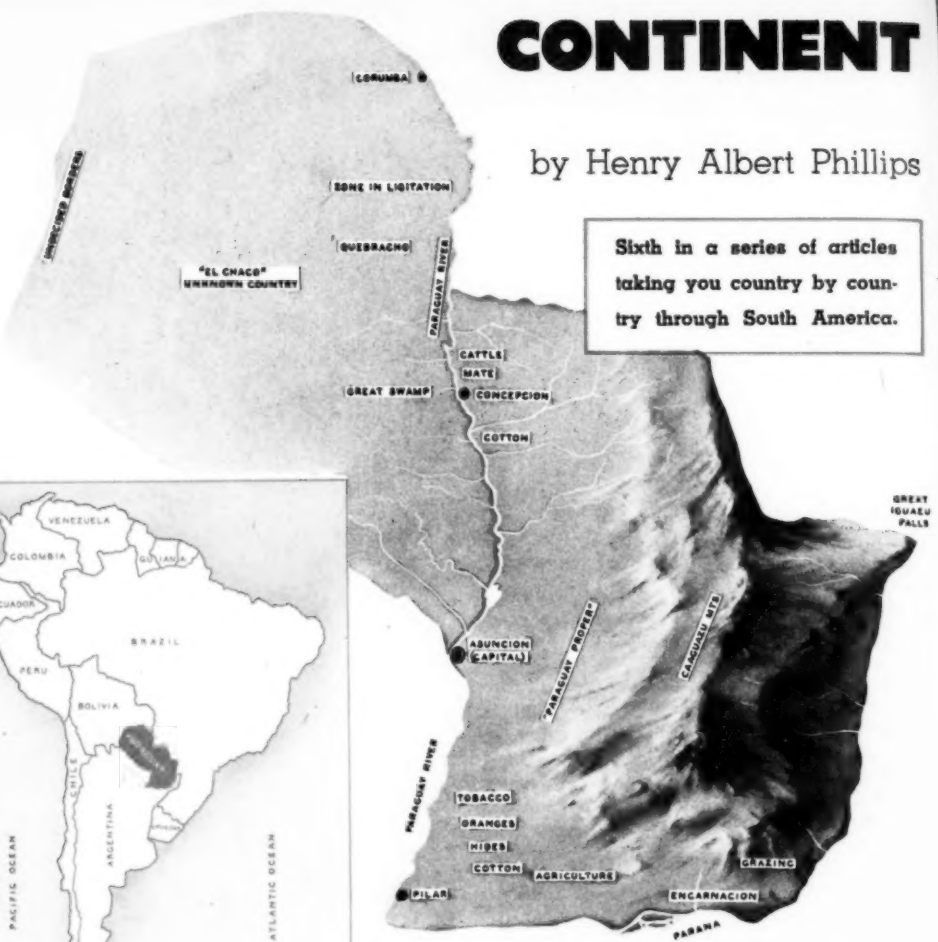


Muddy feet don't help the look of oriental rugs. The butler cleans up after a visitor has departed.

CONTINENT

by Henry Albert Phillips

Sixth in a series of articles taking you country by country through South America.



Tucked away in the heart of South America, pint-sized Paraguay doesn't look like much alongside expansive Brazil and Argentina. But it's lush country, honeycombed with rivers.

NOBODY ever knew him by any other name but "Jim."

People along the Parana could always tell what season it was when they saw Jim standing there on the hurricane deck of the S. S. "Ciudad de Asuncion." If he was wearing his "cottons" it was summer. If he had on his "woolens" it was winter. For he came out of the bush up north twice a year, to bank his "makings" at Buenos Aires; to order supplies; and to get drunk and raise hell for a solid week.

Jim was a sociable cuss and always tried to be helpful to fellow Americans he met along the way. "So, you're agoin' into Paraguay to make your fortune, eh?" he would ask. Then, with a chuckle, he would continue: "Well, there ain't no law in this country against it, son. And Paraguay hasn't changed as much as my little finger in the forty years I been here. You might call it the Wild West of the hemisphere—about the same state of affairs as I used to hear tell that our Southwest was in durin' the prairie schooner days. With rovin' bands of hostile Indians and all.

"Ever hear tell of Paraguay's war with all three of her biggest neighbors t'once? Well, that war had a lot to do with makin' it easy

OF TOMORROW

NO. 6: PARAGUAY

down here for Yanquis like me and you. Little Paraguay took on Brazil, Argentina and Uruguay, and it took 'em five years, from 1865 to 1870, to run down the last of the Paraguayans. They're what I call the fightin'est nation in South America.

"Three-quarters of the population was destroyed. Man-power was all shot to hell, with only about 30,000 men left to do the jobs.

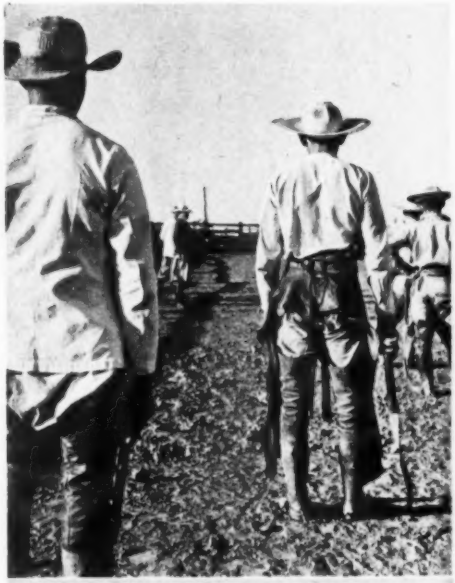
"After about sixty years, the country was just beginnin' to come back some when, believe it or not, if they didn't up and go at it again! They took on Bolivia this time in the Chaco War. That was only settled less than twenty years ago. The loss of each nation, they say, was about the same proportion as those fightin' in World War I. It was now the smallest nation in South America, reckoned by population. Women were runnin' about twelve to one man by that time. You can tell 'em back home that every bachelor in the United States can find a Paraguayan wife, if he wants one. They're mighty good-lookin' too, and handy at makin' lace or haulin' logs.

"But that ain't the only reason they call Paraguay 'The Paradise of South America.' There's fortunes to be made in surroundin's as pretty as any picture you ever seen.

"It's an easy country to travel, too, if you'll stick to the rivers. You can keep goin' for weeks aboard ship and just sleep and eat. It ain't Waldorf-Astoria, but it ain't bad. There's always islands shootin' past; so many of 'em you can't count 'em. Few have been cultivated or claimed even, although there is enough good soil on 'em to feed the world. There's so many turns and twists you've got to go great distances to get anywhere. With every 'flood season' pilots have to learn the channels all over again. Curves, banks and everything are washed away and change positions.

"When once you get off on shore you will find the Paraguayans hospitable people. You can walk right into any house and be well

Women, who are "handy at making lace and hauling logs," are plentiful. So are wild oranges, Paraguay's Yellow Gold, and other tasty fruits.



A lot of Paraguayan men are cowboys. They don't always loll around this way—there's plenty of perambulating beef to look after.

Axe-breaking wood, granite hard, is called "quebracho" down Paraguay way. Here it's being hauled from a plantation by oxcart, the country's favorite transportation system. Dye woods and beautiful grain woods abound.

received. It will be a hut with mud walls and a thatched roof held up by poles. Naked babies will be playin' on the dirt floor or in the open sunshine. They'll give you somethin' to eat out of a pot—probably mandioca, the native flour-potato. There'll be plenty of oranges of course and some *mate* to drink. Then you'll have to have a smoke with them. The whole family smokes, male and female, from babyhood up, for tobacco is plentiful. But, oh my! You will see pretty girls walkin' along a village street puffin' away at a fat black cigar as though their life depended on it. They'll hand you a gourdful of sugar brandy too; but go easy, or you'll want to climb a cocoanut tree instead of climbin' into your grass hammock bed for the night.

"Maybe you'll be takin' a train on one of the few railroads in Paraguay. It'll take its own good time and wait at stations until everybody aboard has et and drunk—mostly drunk. When the train comes in with whistle blowin', they'll all come a-runnin' and they stay there until the train draws out again. Somebody buys up the land as soon as the railroad pushes into the country.

"The farther north you go, the hotter it gets. Unless you've got what it takes, you had better turn around and start headin' south again. Every mile is takin' you toward the Chaco interior. Travellers come hurryin' back with terrible tales about the Chaco. About swamps filled with alligators, pythons, centipedes and scorpions. And Indian tribes layin' in wait.

"Well, it's true and it ain't true—all you hear about this El Chaco country. I been all over it. What's more, I live in the Chaco.

"El Chaco is an Indian word meanin' 'The Huntin' Grounds' and that's just what it is. Thick with jaguars, wolves, ostriches, deer, monkeys, pheasants, parrots. The swamps have got plenty of alligators, pythons, electric eels and stingin' rays. Around those parts the climate is heavy and humid and the insects are fierce. But, by the Lord Harry! What do you want handed to you on a silver tray? Most of these fellers ain't got the guts

to keep goin'. There are tough barriers on every side, sure, but once you break through the border forests and swamps you'll find thousands of acres of fine pasture land, all fertile, fit for cattle or cultivatin'. Why, there's a big successful colony of Mennonites farmin' cotton not so many hours away from where I'm cuttin' quebracho or 'axe-breakin' wood,' as they call it. All around me for hundreds of miles is unlimited grazin' land. No, sir! Nothin's ever prevented me from gettin' into El Chaco. And I've been doin' pretty well too, and am alive to tell the tale after forty years of it.

"That's the way you've got to be down in these parts, young feller. Just go after it. Only don't be too quick on the trigger in buyin' land without seein' it. They're sellin' swamps to greenhorns these days. Buy from the government if you can. The government used to sell run o' the mill land by the square league. You could buy 6,000 acres for $100 in gold. That's about two cents an acre. Good grazin' land jumped to $700 or about 15 cents an acre. A league will pasture about 1,500 head of cattle. Remember, it's got to be fenced to be any use.

"Anything else you want to know, son, you'll have to find out for yourself. So long!"

Oldtimer didn't tell everything by a jugful. Look at the map. Paraguay is about the size of Illinois—375 miles by 200. It occupies a similar position, only it's south of the Equator instead of north. Like Illinois, Paraguay is an inland state, partially bounded, fed and serviced by two great rivers: Illinois by the Ohio and the Mississippi; Paraguay by the Parana and the Paraguay Rivers. Asuncion, the capital of Paraguay, is as far inland from the Atlantic Ocean as is Chicago, with a great river highway to take its people and its goods to the outside world. Thereafter resemblance and parallel cease.

The Paraguay River divides Paraguay into two parts. No such contrasts exist side by side in the civilized world. On the right, or the east side, lies Paraguay proper. On the left, stretching out toward Bolivia on the northwest, lies El Chaco—unknown Paraguay, over the possession of which the Chaco War was fought in land-locked Bolivia's vain effort to obtain an exit to the outer world through a port on the Paraguay River.

Of the million or so population left after the wars, less than 50,000 dwell in El Chaco. Nearly all of them are Indians; most of them friendly, but some of them hostile to whites. After centuries it still remains for the most part a land shrouded in mystery. It is the untouched heart of Paraguay into which few have had the hardihood to penetrate. All this despite the fact that recent scientific explorations have proved it to be a vast semi-tropical paradise with a climate like Florida's. There are 50,000 square miles perfectly suited to immigration; wonderful palm groves, vast forests of hard woods and open pampas for agriculture and grazing. Everybody has a suspicion of the treasures it contains, and some day settlers with a yen for exploration and adventure are going to amaze the world with a revelation of its riches.

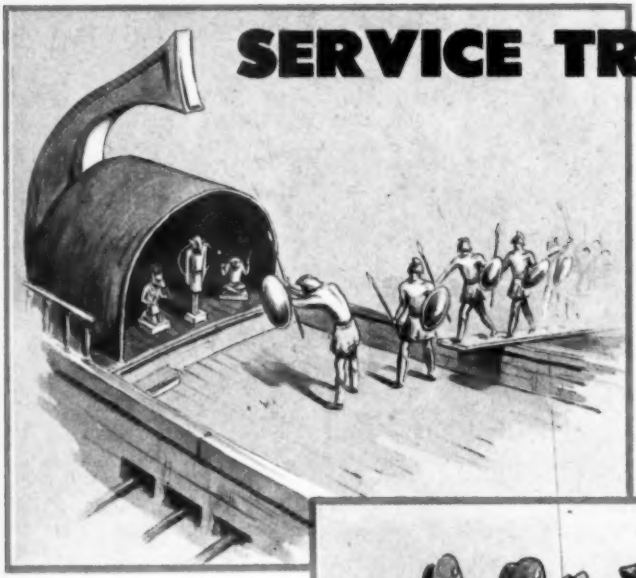
Now, turning to known Paraguay proper, let's get one thing straight. Gold does not seem to be numbered among the treasures of the land. They've got plenty of minerals down there, but like everything else in the country they have never been half developed; perhaps not even discovered yet. Paraguay isn't that sort of a country; no Andes to hurdle, which is where most of the mineral treasures lie. But don't get the idea that it's going to be a cinch for that reason. There are other obstacles that are just as difficult as sky-high mountains to overcome.

For the most part Paraguay is a pleasant and fertile little country. Paraguay proper has pretty good transportation even though it hasn't any roads to speak of above a whisper. No part of the land is far out of touch with the rivers, all of which eventually empty into the Rio de La Plata system, making merchandise accessible by way of Buenos Aires, straight through to the United States.

Paraguay proper they call "cool," but to the American it will seem decidedly tropical.

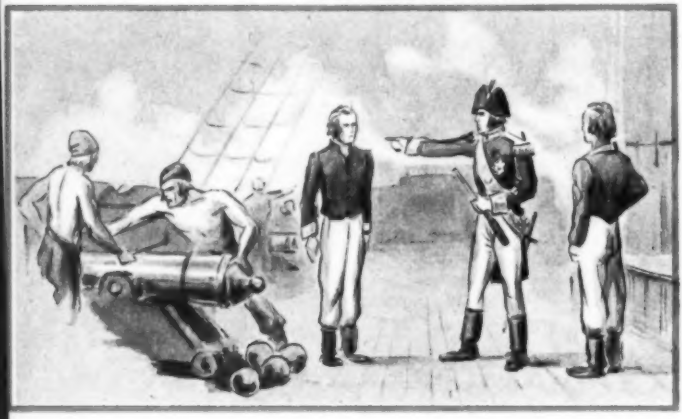
The average American goes crazy over the wide variety and enormous quantity of little Paraguay's products. Take lumber—with every country in the world crying for woods. Forests abound everywhere; hard woods, like quebracho, for tanning; dye-woods; beautiful grains. Imagine Grand Rapids school-desks of Michigan lumber being brought to Paraguay—or huge consignments of furniture pouring into Asuncion from Germany! Part of the reason is that the wheels of fortune in lumber are clogged. It costs too much to haul the lumber to the river banks. Carriage is paid for by the pound. There is so little machinery. Labor is cheap, but measured by other costs it is high. Logs have to be sawed by hand—one man on top and another underneath. What's the matter with an American furniture factory right down in Paraguay near the forests? [*Continued on page* 159]

SERVICE TRADITIONS

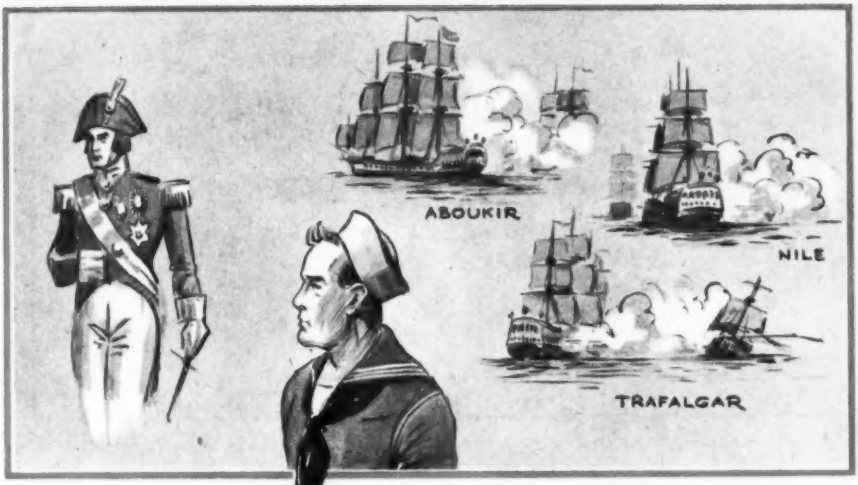


DO YOU KNOW WHY our naval men salute the quarter-deck upon setting foot aboard their ships? Well—Phoenician sailors, circa 2000 B.C., bowed low to pagan altars on the quarter-decks of King Hiram's ships from Tyre. Centuries later the Romans saluted their idols, puppis (dolls or images), hence our "poop" deck, as they boarded their triremes.

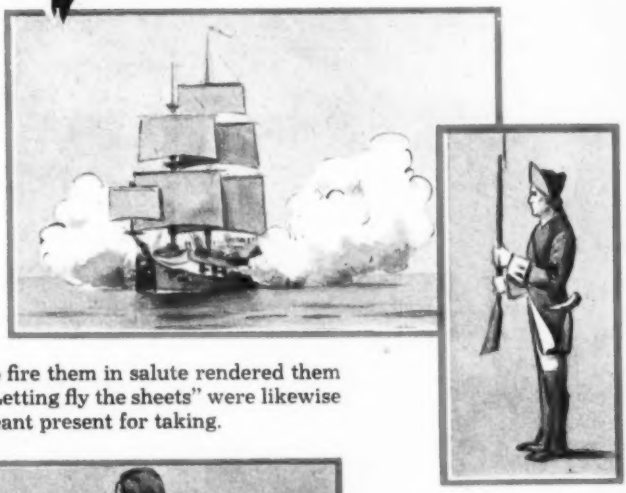
CAN YOU GUESS why one purpose in placing the side-boys, now a guard of honor, on duty is not mentioned in guidance manuals for young officers? The side-boys came in handy when some officer was three sheets to the wind and oblivious to accommodation ladders and the law of gravity. The manual does say they were used to hoist visitors aboard in bad weather.



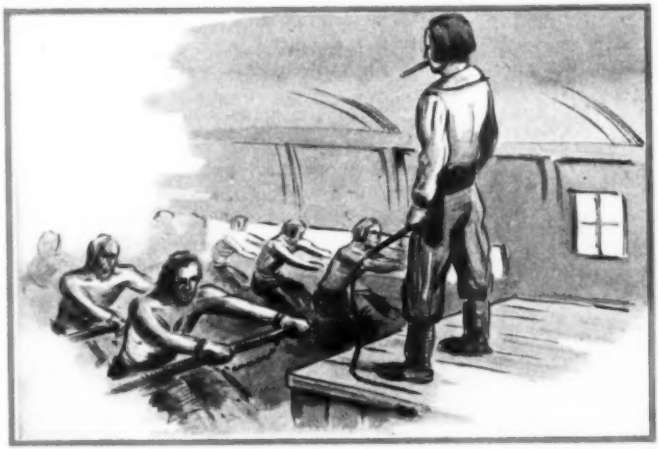
HAS ANYONE TOLD YOU that originally the title midshipman was the most literal in the British Navy? In times gone by midshipman referred to boys or men who were stationed amidships in battle action—to carry messages, to pass ammunition and to relay commands from aft to the gun decks. Now these men are line officers.



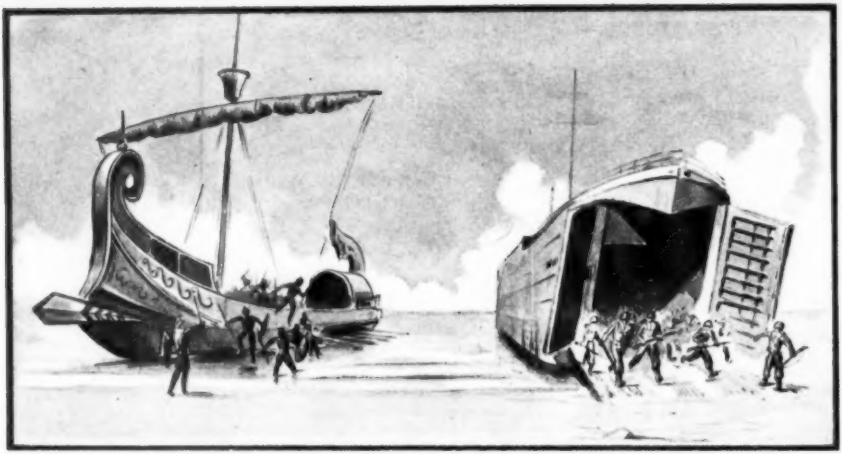
WHY DO OUR sailors wear a black neckerchief and three white stripes around the collar? The black tie is a badge of mourning for the death of Lord Nelson—the three stripes commemorate his great victories, the Nile, Aboukir, Trafalgar.



DO YOU BELIEVE that the purpose of saluting is to show respect? It was far more than that. Guns were kept shotted in olden days. To fire them in salute rendered them harmless. "Lying on oars"—"Letting fly the sheets" were likewise crippling. Presenting arms meant present for taking.



HOW MANY LANDLUBBERS know that the distinctive piece of naval insignia and equipment, the boatswain's pipe, timed the strokes of the galley slaves on the ancient Mediterranean? Later it became a badge of high honor as well as insignia of office. The whistle is eminently practical, piercing through storm and battle noises.

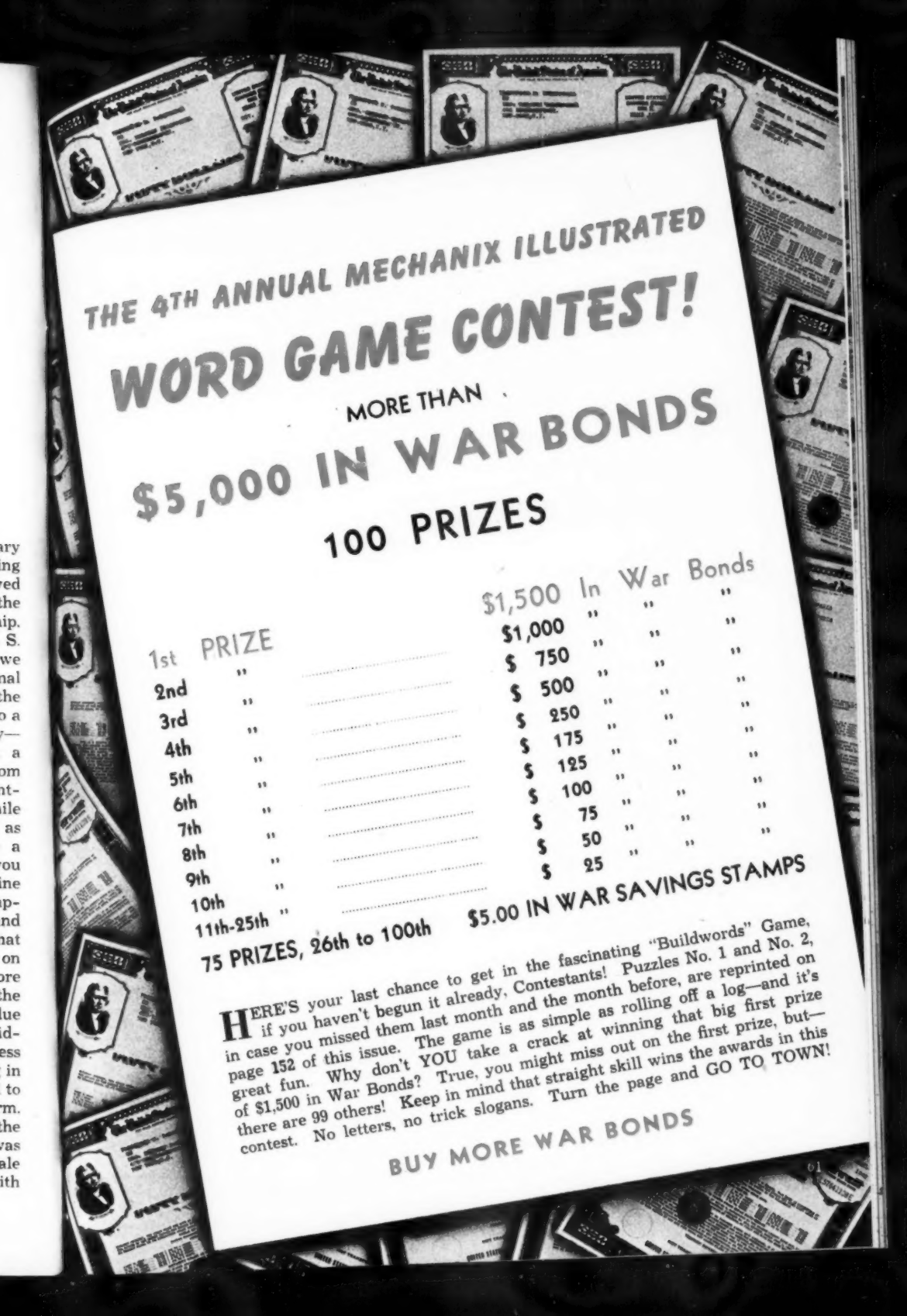


DO YOU KNOW that the marine troops can trace themselves back in history to Darius, King of Persia, 497 B.C.? That Greek and Phoenician navies centuries before the Christian era employed their reckless bravery in landings. Our own Marine Corps antedates our own Navy, even antedating the Declaration of Independence.

CAN YOU PICTURE the cave man's war club behind the baton carried by a field marshal? That was the baton's origin. From that humble beginning also came the scepter of kings, the mace of medieval warriors and the visible symbol of our own Congress' power.

HAVE YOU WONDERED why the Army captain and first lieutenant wear silver bars while the second lieutenant sports a lone bar of gold? Before World War I second lieutenants wore no bar—a single bar designated a first lieutenant. Only gold was available.

CAN YOU TRACE the evolution of military insignia that led to a U. S. general wearing a star? In ancient days uniforms evolved from the liveries of royal servants and the crown became a symbol of royal ownership, as it is with the British now. When the U. S. broke away from the mother country, we carried out the star symbolism of our national flag. And our national bird, the eagle, is the mark of rank of a colonel. But we stick to a British tradition that has confused many—Why does a lieutenant-general outrank a major-general? Major-general rose from the ranks, being a shortening of "sergeant-major-general" in the 17th century, while lieutenant-general was deputed originally as "lieutenant" of the king—and therefore a higher rank given by royal warrant. Do you know that the blowing of "taps" as a routine call began with the Dutch, their word "tap-toe" signifying the time to close up bars and tap rooms in a vicinity? Do you know that our service men wear their decorations on their left breast because the Crusaders wore a cross on the heart side, which is also the shield side? How many know that the blue and white of our Navy were taken from a riding habit of those colors worn by the Duchess of Bedford? British naval officers meeting in their favorite coffee house, in 1745, decided to petition the Admiralty for an official uniform. The Duchess happened to ride by and the color problem of the planned uniforms was ended. Our service traditions have the morale value of linking the modern fighting man with his illustrious past.


THE 4TH ANNUAL MECHANIX ILLUSTRATED
WORD GAME CONTEST!
MORE THAN
$5,000 IN WAR BONDS
100 PRIZES
1st PRIZE ..... $1,500 In War Bonds
2nd " ..... $1,000 " " "
3rd " ..... $ 750 " " "
4th " ..... $ 500 " " "
5th " ..... $ 250 " " "
6th " ..... $ 175 " " "
7th " ..... $ 125 " " "
8th " ..... $ 100 " " "
9th " ..... $ 75 " " "
10th " ..... $ 50 " " "
11th-25th " ..... $ 25 " " "
75 PRIZES, 26th to 100th $5.00 IN WAR SAVINGS STAMPS
HERE'S your last chance to get in the fascinating "Buildwords" Game, if you haven't begun it already, Contestants! Puzzles No. 1 and No. 2, in case you missed them last month and the month before, are reprinted on page 152 of this issue. The game is as simple as rolling off a log—and it's great fun. Why don't YOU take a crack at winning that big first prize of $1,500 in War Bonds? True, you might miss out on the first prize, but—there are 99 others! Keep in mind that straight skill wins the awards in this contest. No letters, no trick slogans. Turn the page and GO TO TOWN!
BUY MORE WAR BONDS

Here Is The Last Puzzle

CONTEST RULES

1. A different "BUILDWORDS" puzzle has appeared in each of the February, March and April issues of MECHANIX ILLUSTRATED. The third puzzle appears on the opposite page. Contestants will complete each of the three puzzles, striving to attain the highest score possible and printing the score in the proper place marked "TOTAL" on each of the entry blanks, together with the name and address of the contestant. The third entry blank contains a space marked "GRAND TOTAL" in which the contestant will print the total accumulated in all three puzzles.

2. The individual having the largest correct grand total as printed in the third entry blank will win first prize. The individual having the second largest grand total will win second prize, etc. In the event of a tie for any prize, the individual turning in the neatest, most original and most legible entry will be awarded the higher prize, with the next prize going to the tying entry. However, "fancy" entries will in no case be given preference.

3. Do not send in entry blanks separately. Save your February and March puzzles until you have completed your April puzzle and send in all three blanks together by first class mail, addressing them to "BUILDWORDS EDITOR," MECHANIX ILLUSTRATED, 1501 Broadway, New York (18), N. Y.

4. Contestants may submit legible copies of the first two entry blanks as their official entry if they so desire. The third entry blank must be the one clipped from the April, 1944, issue of MECHANIX ILLUSTRATED.

5. Webster's New International Dictionary, Second Edition, will be considered final authority on acceptance of words used in the puzzles. Words appearing anywhere in this dictionary, as well as forms of those words in accepted usage as constructed under dictionary rules, will be permissible. However, hyphenated words and possessives formed with an apostrophe are not acceptable. Proper nouns and regular plurals, under dictionary definitions, as well as irregular plurals found in the dictionary, are acceptable.

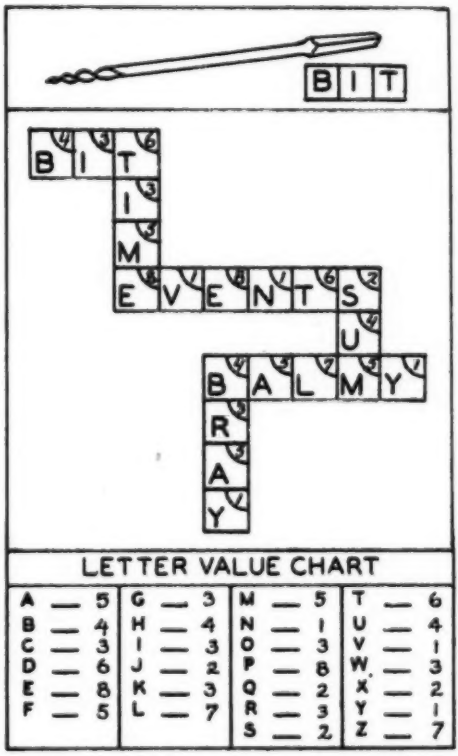
6. No entries will be returned and under no circumstances can we enter into correspondence regarding this contest. Judges will be the Editors of MECHANIX ILLUSTRATED. Their decisions will be final. Anyone in the United States or Canada may compete except employees of Fawcett Publications or members of their families.

7. No contestant may win more than one prize. Neatness, originality and legibility will be considered in judging all entries.

8. This contest closes April 15, 1944. Entries postmarked in the mail later than midnight on that date will not be considered.

9. Prizes in this contest shall be as set forth on the preceding page.

SPECIMEN PUZZLE



LETTER VALUE CHART

A — 5	G — 3	M — 5	T — 6
B — 4	H — 4	N — 1	U — 4
C — 3	I — 3	O — 3	V — 1
D — 6	J — 2	P — 8	W — 3
E — 8	K — 3	Q — 2	X — 2
F — 5	L — 7	R — 3	Y — 1
		S — 2	Z — 7

MY HIGH SCORE IS 82

In The MI PRIZE CONTEST

DEADLINE APRIL 15!

Since magazines are reaching newsstands late because of transportation difficulties, the deadline on the "BUILDWORDS" contest has been extended from April 1 to April 15, 1944.

HOW TO DO "BUILDWORDS"

"BUILDWORDS" is as easy as rolling off a log. Just look at the specimen "BUILDWORDS" on the opposite page. It has been filled out for your guidance.

FIRST: You will notice that the first thing we did on the specimen puzzle was to identify the tool shown in the picture at the top. It's a BIT, of course.

SECOND: We found a three-letter space among the squares below. You will note we put the word in the top three squares. We might just as well have put it in the other three-letter square group where you now find the word SUM. Puzzle No. 3 has a six-letter key word.

THIRD: Fill in the other rows of interlocking squares, using the "T" in BIT as a jumping off place. Use only accepted dictionary words, as explained in the rules. Each letter has a different numerical value, given in the chart below the specimen puzzle. The letters "C" and "N" have the highest value, as you will note, so you obviously should try to get in as many words with "Cs" and "Ns" in them as possible, to bring up your score. Place the numerical value of each letter in the corner of the square. All words must read from top to bottom or from left to right.

FOURTH: After you have fitted words into all of the interlocking squares, as demonstrated in the specimen, add together the values of all the letters and print your total score in the space provided for it at the bottom.

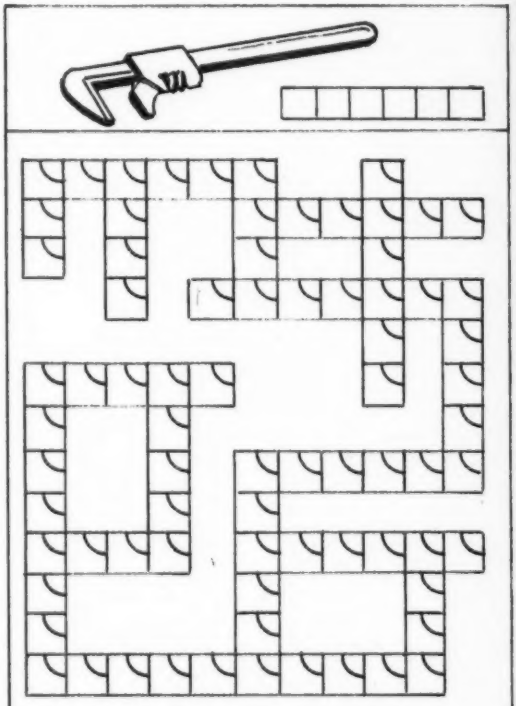
FINALLY: READ THE RULES CAREFULLY AND FOLLOW THEM PRECISELY!

CONTESTANTS

Would you like to have a chance to win a cash prize, as well as one of the regular contest prizes, shown on page 61? If you would, turn to page 149 and see how you can win a Cash Sponsorship prize, merely by telling your friends about MECHANIX ILLUSTRATED'S great "Buildwords" contest!

PUZZLE NO. 3

(PUZZLES NOS. 1 & 2 REPRINTED ON PP 152, 153)



LETTER VALUE CHART

A — 5	G — 3	M — 5	T — 6
B — 4	H — 4	N — 1	U — 4
C — 3	I — 3	O — 3	V — 1
D — 6	J — 2	P — 8	W — 3
E — 8	K — 3	Q — 2	X — 2
F — 5	L — 7	R — 3	Y — 1
		S — 2	Z — 7

MY HIGH SCORE IS

GRAND TOTAL FOR PUZZLES 1, 2 & 3 .....

NAME .....

ADDRESS .....

CITY ..... STATE .....

If you were sponsored in this contest fill out the following. If not, leave these spaces blank.

SPONSOR'S NAME .....

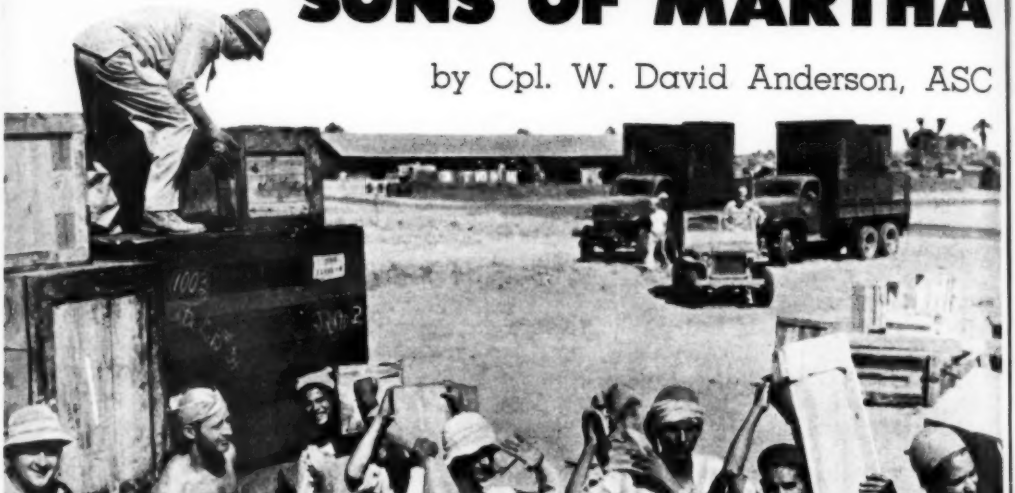
ADDRESS .....

CITY ..... STATE .....

When completed, cut this puzzle out and send in with completed Puzzles No. 1 and No. 2.

SONS OF MARTHA

by Cpl. W. David Anderson, ASC



The ASC pumps a steady torrent of plane parts into the Air Forces' overseas bases. With 300,000 non-service workers in the U.S., plus natives in many foreign lands, it's the largest hirer of civilians in the world.

Says General "Hap" Arnold of the Air Service Command: "It surpasses in size and is doing a wholesale round-the-globe business greater than any mercantile establishment in the world. Its 300 warehouses contain 500,000 different items—five times as many as are listed in the Sears, Roebuck Catalog." It's these forgotten men of the ASC who really keep 'em flying.

ONE THOUSAND bombers were taking off for Berlin. As each one climbed into the night sky, thirteen guys on the ground watched it disappear—and hoped. It was their baby. Their skillful hands had tuned her motors, checked her delicate instruments, laid the block-busters in her cradles. They were as responsible for this raid as the men flying her.

The thirteen guys on the ground—thirteen multiplied by the thousands of planes in the U. S. Army Air Forces—make up the striking force of the Air Service Command, the largest command in the AAF.

An officer of the Eighth Air Force Service Command in England once referred to these thirteen guys on the ground as "the sons of Martha." He explained that Mary, Jesus' Mother, had a sister named Martha. She also had children, but nobody ever heard of them. The folks back home seldom hear about the men of the ASC.

Yet for the past two years they have been doing a job that is fantastic in its size, diversity and complexity. They are, in short, the mail order house, the hardware store, the corner garage and the express agency for our combat planes and their crews. These men, who wear the Air Corps patch on their shoulders but never leave the ground, must accomplish on the double-quick these manifold tasks whether they are working in a large, well-

equipped airdrome here in America or on the battle-ripped shores of Bougainville or the muddy, bloody banks of the Volturno. In two years the sons of Martha and the some 300,000 civilian employes of the Air Service Command have created long and enduring Air Force supply lines and repair services which have rendered obsolete that ugly phrase of two winters ago—"too little, too late."

During the battle of the Volturno, a short time back, the Germans savagely demolished one of Italy's finest airdromes. They wrecked the millions of dollars of hangars, shops and grass-sod runways with systematic ruthlessness. Explosions rocked the countryside; fires burnt for days. Every building, every piece of equipment was destroyed. They blasted great holes on the landing and taxiing strips. As they retreated, they left land mines and booby traps in every conceivable place.

So complete was the devastation of this recent center of the Royal Italian Air Force that a captured Fascist officer, volunteering his services to the Americans, estimated that it would require at least six weeks to make the field available for operations.

Light British tanks still could be seen bouncing and dodging over the hill to the north after the retreating Nazis when Air Force Engineers drew up to the airfield with bulldozers, mobile cranes and graders. Working just behind the mine demolition squads, they filled in a dozen craters, shoved the tangled debris to one side and cleared a 3,500-foot landing strip. At the same time, Air Service Command Mobile Repair units—the men who keep our combat planes in con-

The ASC supplies our aerial warriors with everything from a bolt to a B-17. The half million parts that warplanes require are stored in U.S. warehouses, shipped to fronts all around the globe by huge cargo planes.

In War Theater No. 15, somewhere in the Middle East, a salvage truck manned by ASC experts hauls in a smashed Curtiss P-40 for repairs. These plane doctors nurse total wrecks back to life.

Civilian employees of the ASC's Supply Department keep the traffic flowing smoothly through and out of U.S. warehouses. Here two of them use suction-cup lifts to move a hefty sheet of aluminum safely.

stant fighting trim—cleaned out bomb-blasted, fire-gutted hangars. They dragged hundreds of tons of wrecked enemy planes from the burnt, twisted girders of what a short time ago had been a splendid steel hangar, dumped them in salvage piles around the field.

Throughout these operations, the battle of the Volturno continued. Paratroopers and tanks were operating up ahead. British artillery, set up behind this air base under construction, sent its shells screaming over the heads of the busy workmen.

On the third day, the ASC men had the field sufficiently cleared to enable a flight of RAF reconnaissance Spitfires to make emergency landings, and on the fourth, they sent a message to headquarters far behind the lines. Within an hour the planes began coming in—fighters and dive bombers, each one needing the skilled care and handling of the thirteen guys on the ground.

What was expected to take around six weeks was accomplished in something less than 72 hours.

The Air Service Command was established as a separate branch of the Army Air Forces on October 17, 1941. Its general purpose was threefold: supply, repair, and personnel training.

It is the task of the ASC to supply the AAF with everything from a bolt to a B-17. This entails two gigantic operations: storage and transportation. In twelve major command centers in this country, the ASC has set up one of the most modern and extensive warehouse systems in the world. They hold more than 500,000 different kinds of items, many of which require special treatment such as temperature control and wrapping. These warehouses in America alone, if strung end to end, would cover a strip 100 miles long and 75 feet wide.

The storage system alone surpasses anything yet produced in private business. Comparable on a much smaller scale is a large mail-order house which lists some 40,000 different items at the most in its catalog.

The army commissioned supply experts from large concerns for the specific purpose of establishing and maintaining this elaborate warehouse setup, which is duplicated in the theaters overseas. By a systematic yet simple arrangement, they have devised a storage scheme whereby a worker from the Rome (New York) Air Service Command can transfer to the Sacramento (California) Air Service Command or even an ASC supply depot in India and know exactly where to go to find a specific item on a moment's notice.

Moreover, detailed and readily available records are kept of all supplies that are shipped from a depot so that if a freighter, carrying vital Air Forces equipment, is sunk in the mid Pacific, a punch-card system installed at ASC headquarters and at all of the main depots makes it possible to determine every item on the order and replace it within a matter of hours.

The handling of supply also involves its transportation. Air Force supplies cross the continent from one depot to another or to ports of embarkation by truck, train and plane. For high priority freight, though, the ASC operates the 39th Air Freight Wing, which has its own air freight terminals at 117 points along the Army's 50,000-mile air transport system in the United States. The Wing also loads all the cargo planes flown by Air Transport Command and prepares the routings.

Overseas, the bulk of freight movements from depots to combat zones is done by cargo aircraft. From the time Rommel began his retreat in Libya to the fall of Sicily between 75 and 80 percent of all air corps supplies moved from the base supply depots to the front were [*Continued on page* 156]

HOBBY HOUSE

C. F. BURGESS, Chicago businessman with some 400 inventions to his credit, makes gadgets pay. His two hobbyists' stores in Chicago and Miami are clearing houses for inventions. Tinkerers buy a bewildering variety of gadgets from these shops, putter around with them in their workshops, find new applications for them. Burgess gets 'em coming and going.

Here's Burgess' store in the Chicago loop. Hobbyists rummage through the gadgets galore heaped on the counters.

At left, Nathan Rubel looks over the blueprints for a model boat available in this Chicago hobbyists' hangout.

Above, Burgess himself, a tinkerer's tinkerer, demonstrates a model plane to an audience of Chicago youngsters.

Left, Mrs. Betty Truppe buys her husband a vibra-tool, a gadget that makes 7,200 up-and-down strokes a minute.

THE "SQUIRT"

by Willy Ley

The propellerless, jet-propulsion plane sucks in air, heats it, pushes it into a compressor. There it mixes with burning fuel, building up pressure. Gases escaping through a nozzle create the jet.

Talking about secret weapons, here's one for our side—the sensational new "Squirt," British-designed plane that's heaved forward by an exhaust-gas jet. Already the plane-without-propellers is being turned out by Bell Aircraft in this country, powered by General Electric engines. Here's the lowdown on how the ship works, by MI's rocket expert.

HARD on the heels of the Nazi Propaganda Ministry's announcement to the world about Hitler's new and terrible secret weapons, the Allies disclosed one of their own: a jet-propelled airplane originally developed in England by Group Captain Frank Whittle of the RAF.

It is doubtful whether this release was deliberately timed to counteract whatever small measure of success the German propa-

ganda may have had. It was stated by British sources that the secret had to come out simply because it was not a real secret any longer, too many people having seen the "Squirt," as they called it, during test flights.

Captain Whittle's Squirt is not the first jet-propelled plane, but it is the first which can be called successful. The first jet-propelled plane which attracted attention was an Italian design, worked out by an Italian engineer by the name of Secondo Campini and built by the firm of Caproni. Since it was the second model of its kind it was called the CC-2. This CC-2 made a much publicized flight from an airdrome near Milan to an airdrome near Rome in December, 1941. The distance is around 170 miles, and the average speed attained by the plane was about 90 m.p.h. The pilot had to land at Pisa for the rumored purpose of refuelling.

The British, when they heard about this—and the few Americans then "in the know"—must have smiled. By that time the Squirt had already made its first successful flight. No performance data on the first flight are available, nor has it been stated just how fast the present model can go, but British observers have said that the Squirt "makes Spitfires seem slow" and have estimated its speed at about 600 m.p.h.

It was later revealed that the first American model had been built by Bell Aircraft, with engines built by General Electric. To this general information the more specific information was added that the plane resembles the P-38 Lockheed Lightning in general appearance and that it runs on kerosene. If you add to this the admission of very high fuel consumption, the report that British civilians at first fled into shelters during test flights because they thought the noise was caused by a large bomb, and the statement made by various airmen that an experienced pilot should have no trouble at all flying the Squirt, you know everything that a civilian should know about it at the present time.

About the engine of the Squirt it has only been stated that it consists in the main of an air compressor and a turbine. We can be fairly certain that there have been modifications since the description of the engine was published, but the general principle seems to have remained the same.

Yes, a description of the early version of Captain Whittle's jet-engine has been published in print. As early as 1938 it was discussed in the German magazine Flugsport and a description appeared, together with a detailed diagram, in September, 1941 in the British magazine Flight.

This description shows clearly why the Squirt is so much more successful than the CC-2. In the CC-2 the process was as follows: the air was sucked in through the open nose of the fuselage, passed a radial engine mounted inside the fuselage and was then compressed by a two-stage rotary compressor, turned by the radial engine. Then thin streams of fuel were jetted into the compressed air and ignited. The jet consisted of the products of the combustion, plus a large amount of surplus air, plus the exhaust of the radial engine. The machinery took up the entire fuselage so that the cabin for the pilot had to be perched on top of it.

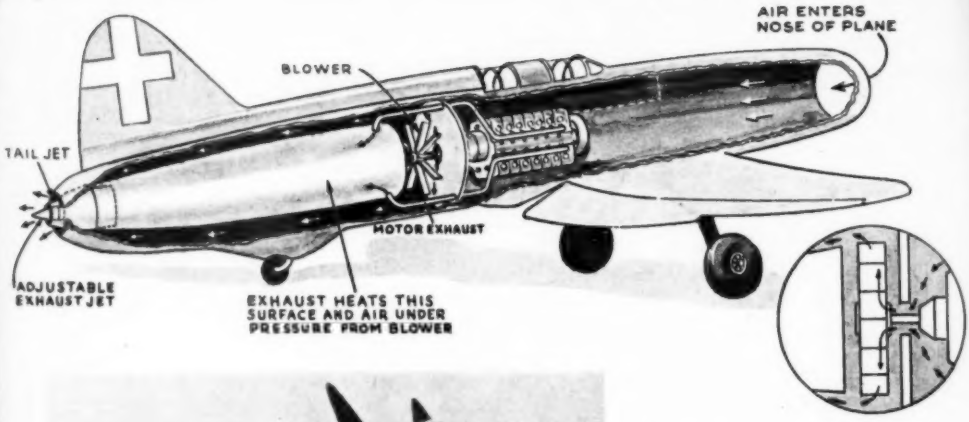
In the first Whittle system the procedure was much simpler. The air was sucked in and compressed by a compressor built along the same lines as a supercharger. This fed it into a wide air duct into which fuel was injected and ignited. The rapidly expanding (because hot) stream of combustion products and air then turned a turbine wheel. It was this turbine which furnished the power for the compressor. The stream of hot gases and air does lose some energy in the process, but even after passing the turbine it still produces a powerful jet. And it is this jet which propels the plane.

It is interesting to note that each one of the component parts is well known to engineering science. Captain Whittle's merit consists in combining these parts properly and in making them behave as theory said they might, but as many experts suspected they would not.

There is a great deal of confusion between jet propulsion and rocket propulsion. The underlying reason for this confusion is, of course, that a rocket produces a jet too. As a matter of fact both are alike as far as the "outside" functioning is concerned. Both move by the reaction of a jet.

The difference is the nature of the jet. In a true rocket, such as, for example, the shell of the bazooka, the jet or, better, the exhaust blast, consists solely of the combustion products of the fuel—in the case of a bazooka shell, of the gases generated by burning the powder of the propelling charge. A jet, as used in jet airplanes, consists mainly of atmospheric air which has been heated by the combustion of some fuel. Of course the combustion products are mixed in in the process.

It is also interesting to note, and it should,



First jet plane to hit the headlines was the CC-2, built by Caproni-Campini in Italy. It hit 90 m.p.h. during 1941 tests, then speedily vanished. But by then the Squirt had proved its worth.

perhaps, be emphasized, that every airplane is, in effect, a jet-propelled plane. In every airplane the propeller gathers up large masses of atmospheric air and throws them back, thus creating a jet which propels the plane. The difference is, in the first place, one of method. The "jet" of a propeller plane flows around the fuselage or engine nacelles, while in the jet system the air flows through the mechanism that produces it. In the second place the temperature of the air used in the propeller system is virtually unchanged, while in the jet system the air is deliberately heated to make it expand and leave the exhaust nozzle faster.

The result is that the "jet" of a propeller plane is by far slower than the jet which emerges from the exhaust nozzle of a jet plane. It might also be claimed as an advantage for the jet system that the mechanism is much simpler (at least in the Whittle system; it certainly wasn't in the Campini system) and that the turbine jet plane will eat almost any kind of fuel (it probably could be made to run on powdered coal) while the highly developed internal combustion engine needs gasoline with a high octane rating.

But the main question is really what the faster jet will do for the plane. The obvious answer is that it will produce a higher speed. In fact, unless the speed is higher than that of even the fastest present day propeller airplanes the efficiency becomes so low that the whole change is not only useless but a definite drawback. There is no such thing as a low-speed jet-propelled plane.

Now a high speed can almost always be classified as an advantage.

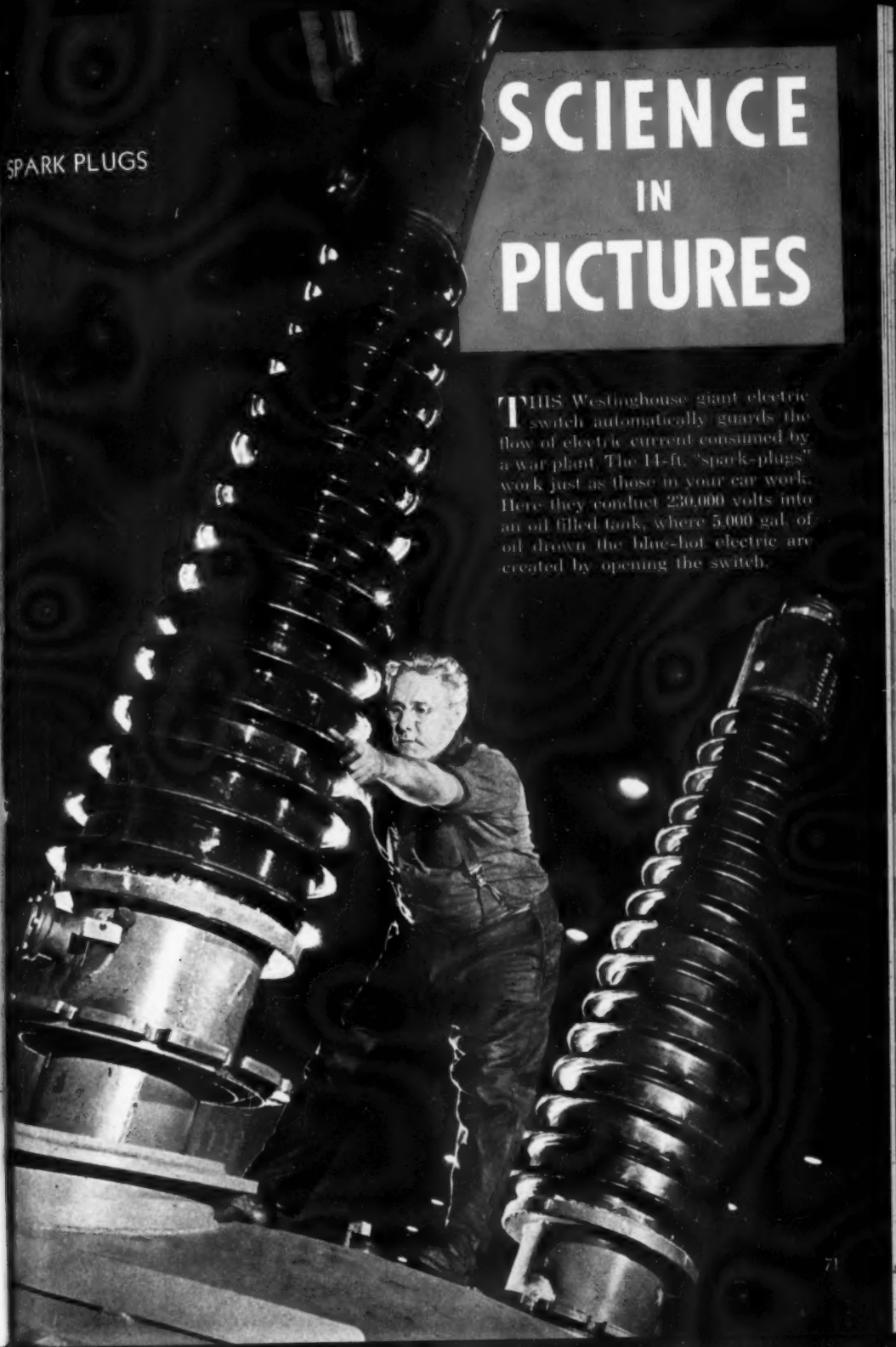
But there is a disadvantage connected with the jet system too, freely admitted by British experts. The fuel consumption is high. And at present nobody knows of a way to cut it down. As a matter of fact theoretical considerations make it seem unlikely that it ever can be cut down to any considerable extent.

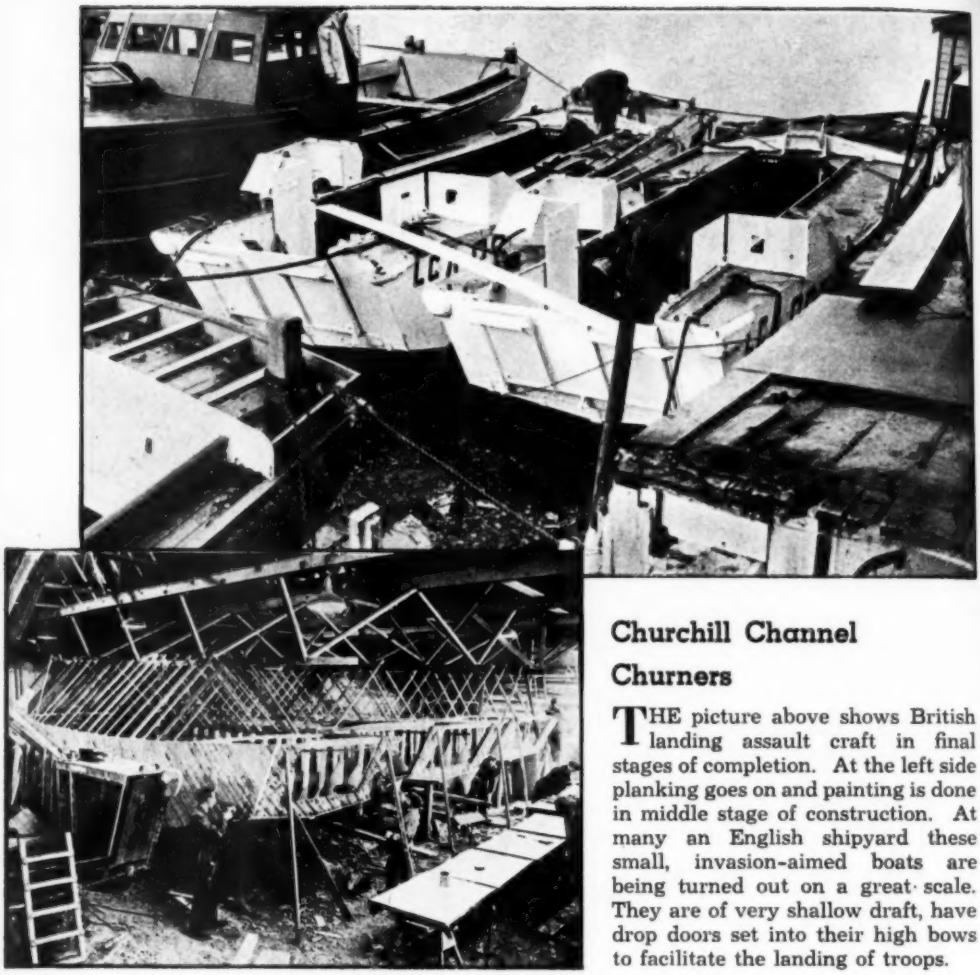
If you combine the two main features, inherently high speed and inherently high fuel consumption, you get a plane which is very fast but has little "endurance," in other words a comparatively short range. In fact it owes what range it has mainly to its enormous speed. If you have only half an hour's operation with a plane that does only 200 m.p.h., you can, at the very best, bridge a distance of a hundred miles. But if you get, say, eight hundred miles out of it for half an hour you can contemplate bridging a distance of about four hundred miles.

SPARK PLUGS

SCIENCE IN PICTURES

THIS Westinghouse giant electric switch automatically guards the flow of electric current consumed by a war plant. The 14-ft. "spark-plugs" work just as those in your car work. Here they conduct 230,000 volts into an oil filled tank, where 5,000 gal. of oil drown the blue-hot electric arc created by opening the switch.





Churchill Channel Churners

THE picture above shows British landing assault craft in final stages of completion. At the left side planking goes on and painting is done in middle stage of construction. At many an English shipyard these small, invasion-aimed boats are being turned out on a great scale. They are of very shallow draft, have drop doors set into their high bows to facilitate the landing of troops.

A Machine Shop That Fights

HERE'S a new one—an LCBE or landing craft for busted equipment. Our amphibious forces take everything along with them to make them independent. This craft plows right on in under fire to set up shop on the battlefront and make needed repairs as the fighting goes on. This particular floating machine shop is chugging up to Munda on New Georgia Island.

LIGHTER MOMENTS with fresh Eveready Batteries

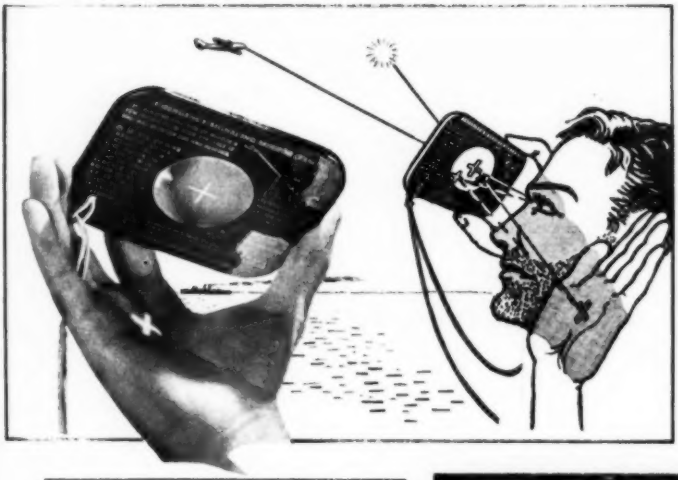
"Tell the Mess Sergeant to look up the recipe for turtle soup."

POWERFUL little "Eveready" "Mini-Max" batteries make the armed forces 2-way radios practicable. The reason your dealer has none on his shelves today is that our entire production is now going to the armed forces.

You, personally, can save a soldier's life by giving a pint of blood to the Red Cross. They maintain Blood Donor Centers in 35 cities. Call for an appointment now!

The words "Eveready" and "Mini-Max" are registered trade-marks of National Carbon Company, Inc.

EVEREADY
TRADE-MARK



S.O.S. Mirror

LOST soldiers, shipwrecked sailors, downed airmen now carry a signaling mirror. It has a full mirror on its face, a round one on its back with sighting cross at center. Mirror is aimed at a point halfway between sun and target. Sun prints a cross on upraised hand, mirror is then tilted until cross on hand is reflected from back mirror and finally superimposed on sighting cross. Range? 10 miles.

Gob's Globe

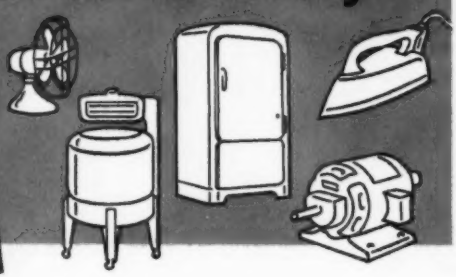
A NEW celestial navigation instrument has a sextant, a quick means of determining true north, sun time, latitude, great circle course and direction. It's for life rafts. Made of corrosion-proof Plexiglas it weighs 1 lb., will float in water, can be seen at night for 25 feet. The globe combines a miniature of the celestial sphere, with names and precise locations of the 22 navigational stars, and a world globe with all coordinates. Involved calculations, nautical almanac, sextant and compass, are done away with.

Depth Projection

IT USED to be tough to teach military navigation students to read depth into chalk drawings. Now Polaroid 3-dimensional pictures, vectographs, are used. These are projected on a screen for group instruction. If an instructor walks into the beam of the vectograph of the globe (shown at left) projected on a screen, he appears to be walking into the center of the earth. Now students learn rapidly to steer by the stars.

America's War Made Industry—

ELECTRICAL APPLIANCE REPAIRING



OFFERS BIG MONEY

The restrictions on the manufacture of electrical home appliances has greatly increased the need for and earnings of skilled home appliance repairmen. Always a good business, today ELECTRICAL APPLIANCE REPAIRING is one of the most profitable occupations that the average mechanically inclined man can turn to. On many types of repairs it is usual for a repairman to charge on the basis of $5.00 to $6.00 an hour!

PERSONAL INDEPENDENCE

Work as many hours as you wish—for the home appliance repairman is his own boss. Establish yourself in a profitable lifetime business. Operate from your garage, basement, vacant store, etc. You don't need elaborate fixtures or expensive equipment to be a successful repairman. If now in war work, start your home appliance repair business in your spare time and be set with a business of your own when the war is over.

NO EXPERIENCE NEEDED—New Course Tells All

If you are at all mechanically inclined—that is to say—can hold and use tools—then you have all the qualifications required for becoming a big money-earning home appliance repairman. It does not matter if you have not had a great deal of schooling or had no previous training along these lines. Age is no barrier . . . nor is any minor physical handicap.

Profusely illustrated, our new course shows you in simple, easy to understand language and drawings how to make each repair on refrigerators, vacuum cleaners, washing machines, motors, etc. Explains and gives you a working knowledge of electricity, welding, nickel plating, etc. Shows how to build the power tools you need and how to solicit and keep business coming to you. Not a theory course but an honest to goodness course written by and used by repairmen the Country over. Price of course is so low that the savings on your own household appliance repairs will quickly pay for it. Act now!

Read What Other Students Say

I really believe your course the best investment a mechanically minded man can make.—*Claude E. Allen, Indianapolis, Ind.*

Your course on Appliance Servicing is the most complete and up-to-date I have heard of.—*Frank Kremen, Tarentum, Penn.*

I have received your Course in Appliance Repairing and I must say I am well pleased with same. I am only sorry I did not have said Course some years ago. I have learned so much more through this course I would not part with it.—*Charles Schwarz, Hamilton, Ohio.*

The Course in Appliance Servicing arrived a few days ago. Want to take out a few minutes of my valuable time to let you know that this is just what I have been looking for ever since I opened up my Fix-It shop. I must admit that you told the truth when you said that it contains quite a bit more information than I bargained for.—*P. J. Brett, Sebring, Ohio.*

I am a mechanic for the Western Union Telegraph Co. Three days after receiving the lessons in refrigeration I earned the exact cost of the course.—*Henry S. Lee, Washington, D. C.*

I shall appreciate hearing from you all once more as I would not take $200.00 for my book of lessons.—*Albert Losli, Denver, Colorado.*

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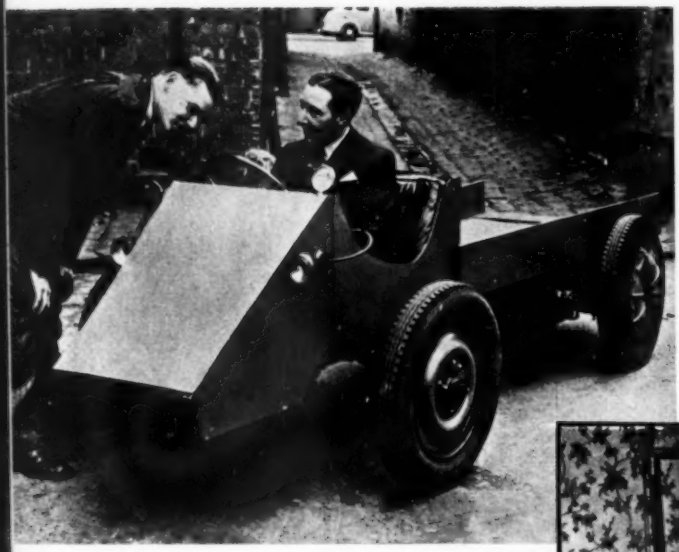
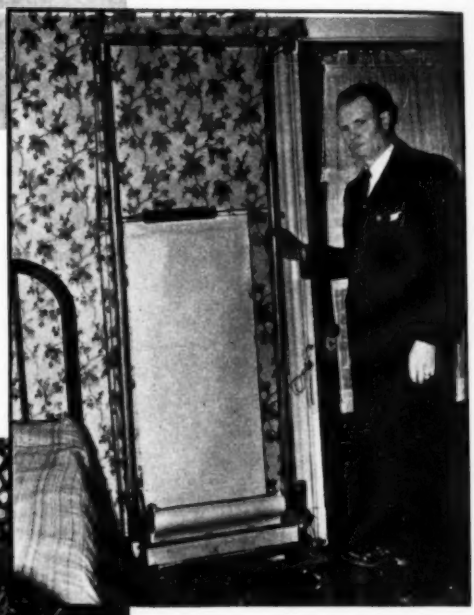


Aussie "Juice" Jeep Comes Through

IN MELBOURNE, AUSTRALIA, John and Len Bowker show off the tiny electric car in which they set an endurance record for this type of machine. It ran continuously for 111 miles, the top speed being 30 m.p.h. Recharging the batteries sets the constructors of the midget back about 55 cents. This model seems to be a light truck type.



One-Armed Paper-Hanger Can Scratch Now

GAZE upon the reason for the end of a proverbial joke! M. J. Horan, Brighton, Mass., has invented a paste-applying, paper-hanging machine. It applies paste, trims selvedge and rolls paper into position.

The Mint Starts Shooting, Too

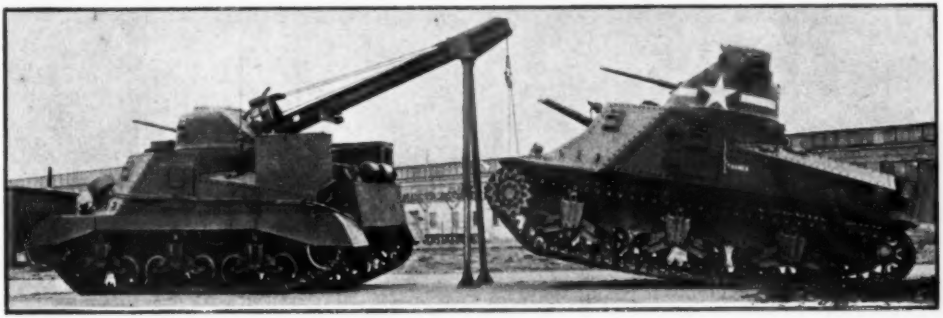
NAZIS and Japs have been on one business end of these .30 and .50 cal. cartridges. Now the mint in Philadelphia is doing business with what is left. Our new pennies will be coined from these war leftovers at the rate of 3,000,000 per day. Present white metal pennies will not be recalled, however.

Mobile One-Two For U.S. Army

WHEN U. S. troops have a real tough spot to knock out, they call upon their deadliest combat team —an M-5 tank and the new M-8 military vehicle shown here. In effect, this wallop on tracks is nothing but a 75 mm. "pack" howitzer mounted on an M-5 light tank chassis. It's the speediest, most maneuverable weapon of its type in action today.

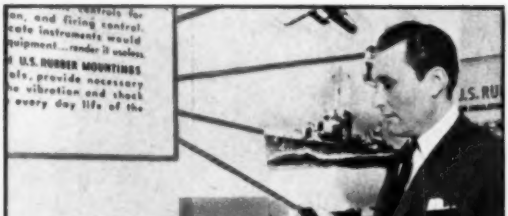
Knockout Blast Russian Style

THE Red Army, too, has plenty of artillery that gets around. Here's one of the heaviest of the Russian self-propelled guns, a 128 mm. cannon mounted on a medium tank chassis. This weapon may not be as fast as the American M-8, but what it lacks in maneuverability it makes up in fire power. This roving cannon has knocked out plenty of Nazi Tigers and Ferdinands.



Business Boom For Tank Doctors

THIS M-3 tank is being lifted by the U. S. Army's latest repair unit, a heavily armored, track mounted tank retriever. This power-boom machine carries a supply of tools, parts and equipment. Its four-man crew can remove turrets or engines on the spot.



Marvelous Mountings

HOW many things vibrate and dance around in your house? When this war is over there will be mountings that eliminate noticeable vibration. The U. S. Rubber Co. has produced them for the war effort now. In the two pictures above are shake tables. On them a mock-up, having the exact dimensions and weight of an Army aircraft radio is mounted. There is practically no vibration within this radio while the shake table is in operation, but the shake table itself literally has the jitters (note cup placed on top of both). Tiny rubber mountings set between shake table and radio mock-up achieve this result. Thus delicate instruments in planes, ships, tanks, etc., are insulated against shock.

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A Darn Dirty Trick But—

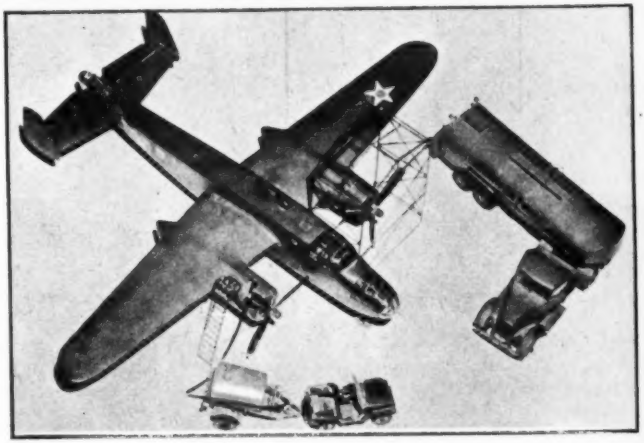
THEY are fooling mother birds now. Look closely, at right, and note the dummy bird's head being fed by a gullible live bird from outside the bird house. Below the dummy is a beaker that catches all that falls through the bottomless lower bill. Purpose? Science wants to know bird diets. Thus can they be classified accurately as to value as insect destroyers. Horticulturists, farmers, Victory gardeners will really know how to rate that robin's importance around growing plants.

The Reds Pull Nazi Teeth

IN MOSCOW these Nazi mobile pill boxes were exhibited soon after Red troops pulled them up out of the ground as they advanced. Germans use them as two man machine gun posts. They are hauled up to the battle front, set partly below ground. Story: the Russians come along and pull 'em up as souvenirs.

Models That Help Maintenance

PERFECT miniatures are saving time and money for the government. Built to 1/30th actual size, they are used to help develop new maintenance, repair devices, etc. Notice tiny ladder and engine shelter on motors of a B-25 bomber. The jeep tows a field gas tank that feeds a wing tank by hose. (Atop of left engine nacelle.)

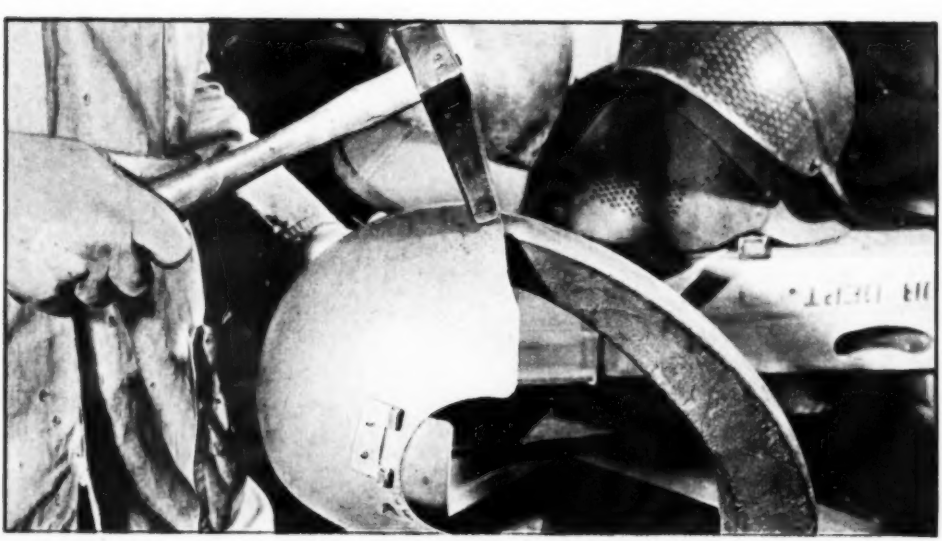


Winged Tire

GROUND friction devours aircraft tires, particularly as the planes land. Here's a tire with little wings of its own built into its sidewall. These fins catch the wind and start the tire spinning before it touches the ground. The fins spring back flush on the upper half of each rotation of the wheel.

For A Small World

THE Army has a new aerial camera that can photograph this old orb from altitudes of 40,000 ft. and more. Enemy territory will not benefit. An Eastman Kodak Co. lab worker, rigged up like an eskimo, is about to give it a 70 below zero test, a tougher ordeal than it will meet in actual use.

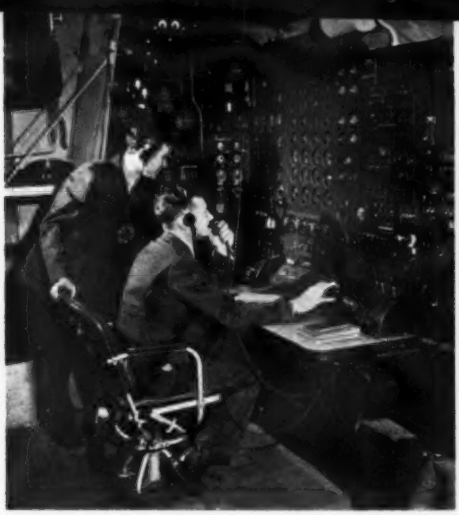


To Armor Noggins

IN NEW YORK'S Metropolitan Museum of Art armorers are using tools centuries old to make models of war helmets from which dies are cast in Detroit. That's an ancient drawing hammer, the kind used to make Sir Launcelot a crusader's helmet. With our modern crusade at its hottest, the work of these craftsmen is invaluable.

Cruiser Carrier

DO ALL aircraft carriers look alike? Study this one. It's a converted cruiser, termed Independence Class. Important factors: Has a cruiser's speed teamed up with hitting power of a plane carrier; 10,000-ton class, maneuverability. Note rakish lines beneath superstructure.



Mars Ouija Board

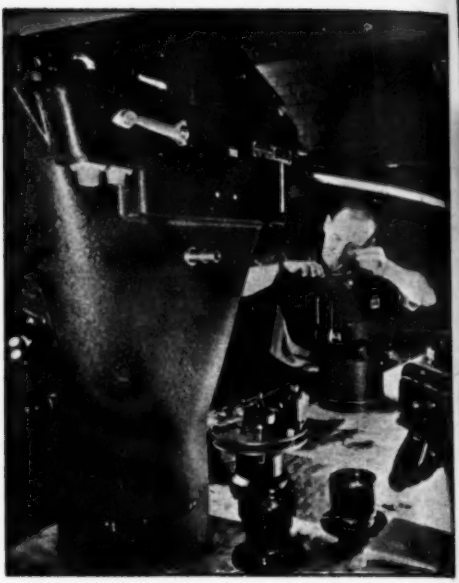
EVERY phase of operational activity is indicated on the immense panel on the flight deck of the Navy's flying boat Mars (PB2M-I). The great ship has broken all records for carrying men and material across the Pacific. Here the flight engineer gives an order. How many eyes has that man got?

A Hell Of A Diver

THE U. S. Navy's new Curtiss (SB2C-I) Helldiver dive-bombers had a coming-out party at Rabaul. Only the Japs know what a party it was—the last of them to dive for life. It carries a greater bomb load faster and farther than any similar type, incorporates all dive-bombing advances learned in World War II; has a full feathering propeller.

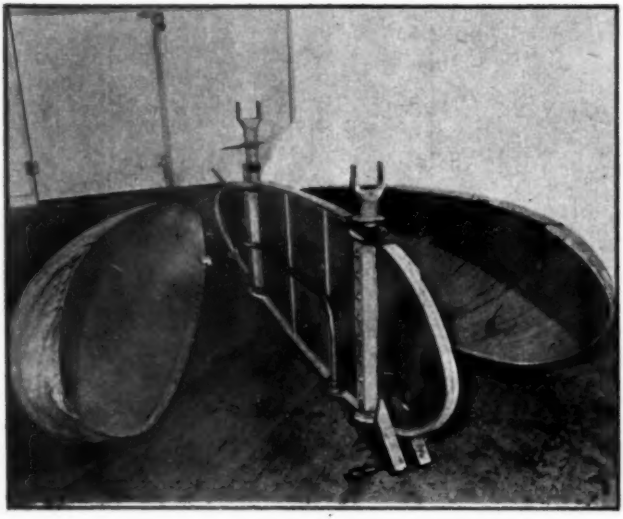
Dial Your Tolls

LONG DISTANCE? No need of asking for that anymore. The Southern Calif. Telephone Co. has fixed it so that toll calls may be dialed directly. Key to the device is a ticket in the phone office that records all data on each call. An automatic record shows the calling and called numbers, equipment through which call progressed, class of service, rate, date, elapsed time of call.



Naval Retina

THE Navy's brand new photo science lab is at Anacostia, D. C. Scientific photography is recording fleet maneuvers, flight and armor piercing facts of projectiles, medical research work, progress records of ship production, the movement of stars. Here a technician tests an F-56-20 aerial camera. Huge camera in left foreground is a K 18-24 type. This science lab is staffed night and day.

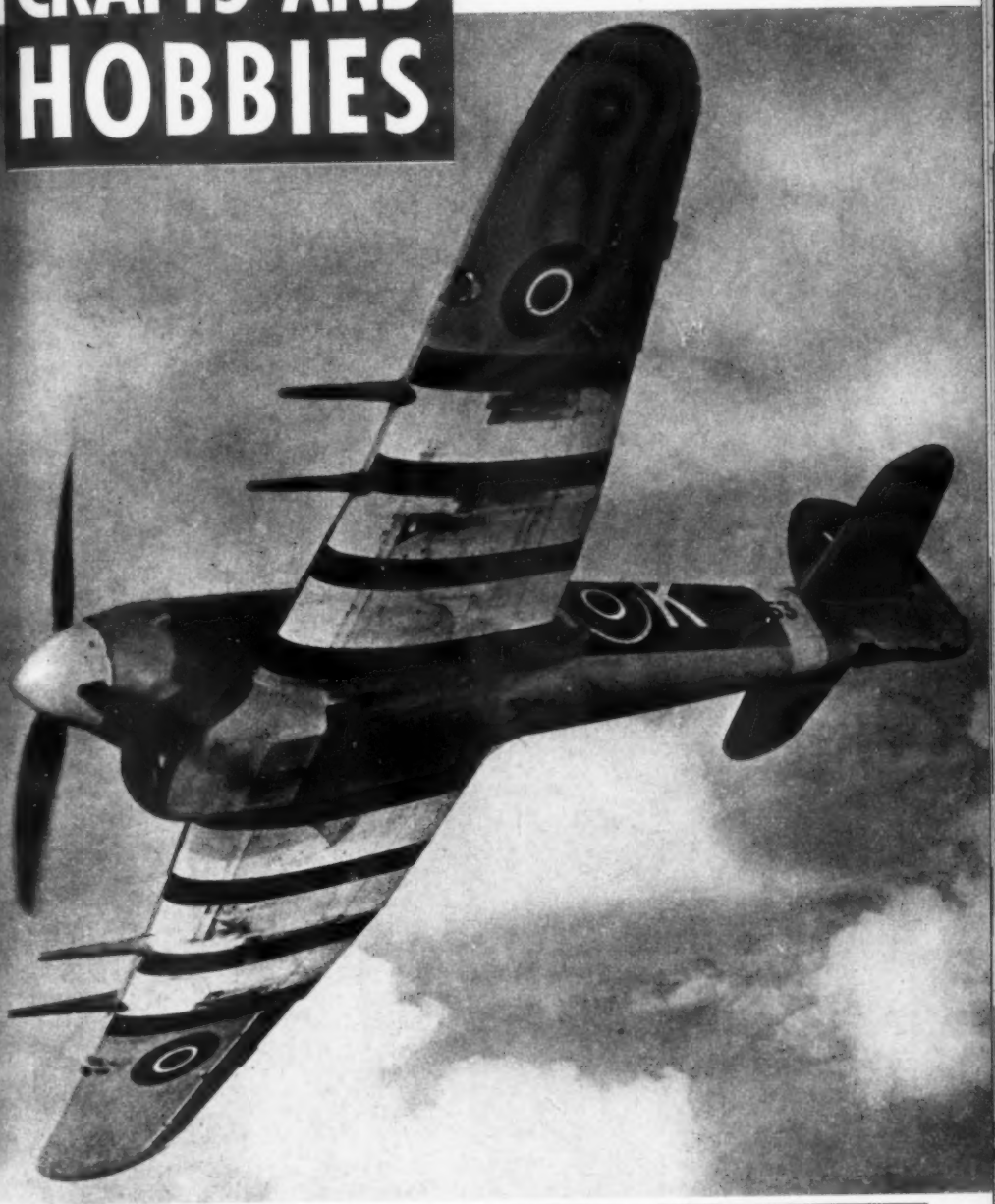


Fuel Tank On The Half Shell

THIS is one of the expendable fuel tanks toted by our Navy's Jap-blasting Corsair, showing half shells and center bulkhead. The Fairchild Corp. uses electronic processing to get a uniform degree of heat to all of the glue lines in laminated sections, a hitherto unsolved problem. Process is called Duramold. These streamlined tanks are extremely light, strong, durable. When empty, pilots drop them by simply pushing a button.

CRAFTS AND HOBBIES

Build a Typhoon flying model (page 108).



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MITE CYCLE

You'll need only an "A" ration to run this midget motorcycle.

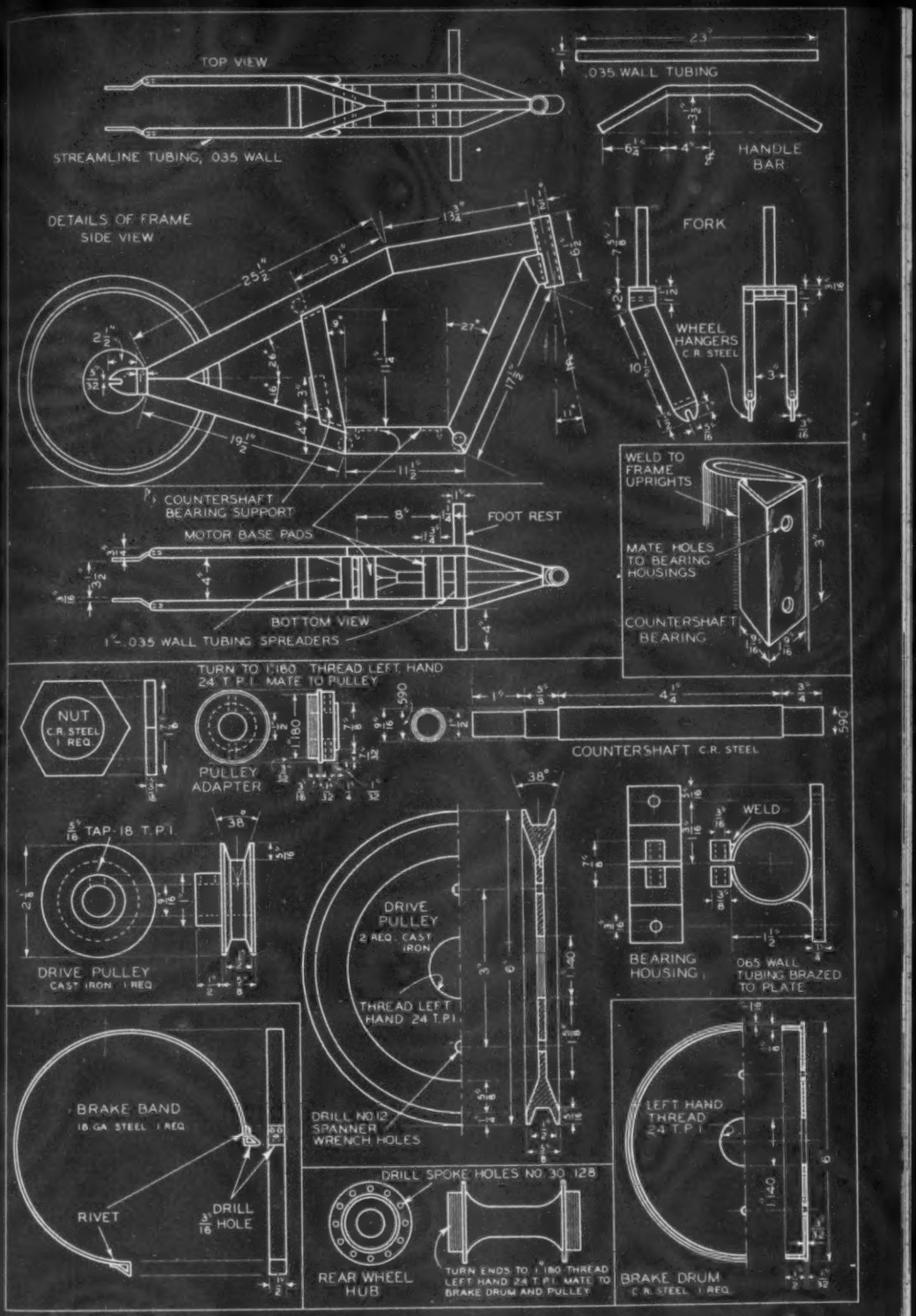
by R. G. Fisher

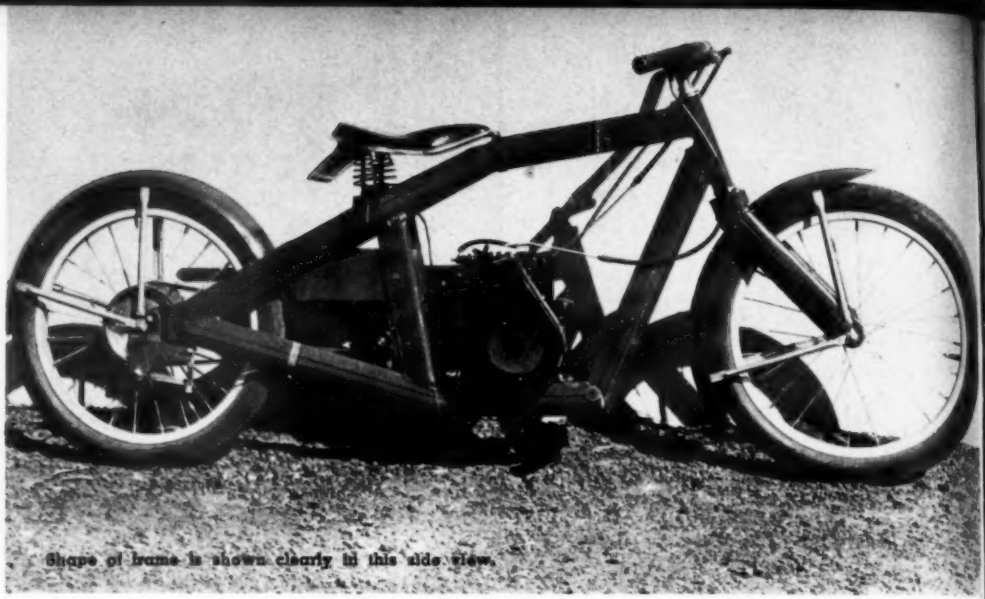
The Mite Cycle, with its builder, is shown above. A small one-cylinder engine provides the motive power.

THIS little motorcycle has been designed to operate on wartime rations! Its construction is simple and light, but it is surprisingly practical and will carry a 250-lb. passenger without complaining. A ⅝-h.p. engine whips it along at a 25-m.p.h. clip and as for gas consumption—one gallon for every 120 miles, and we doubt if there's another motorcycle that can do better than that.

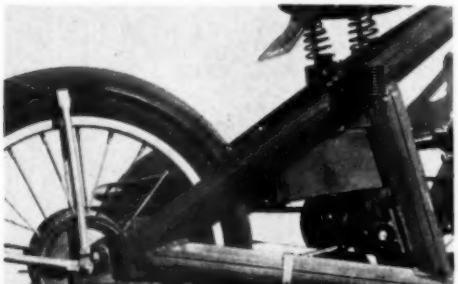
The Mite Cycle shown here was built by the author at a total cost of $50. It weighs 85 lbs. and is powered by a Briggs and Stratton engine. All unnecessary frills were forgotten in its construction, and the only tools used were a small lathe, a hack saw and a welding torch.

The frame, being the foundation of the project, should be built first. It is made of salvaged aircraft streamline tubing, 2½"x.035 wall, procurable from any airport where small planes are repaired. These dimensions need not be adhered to exactly as a slightly larger or smaller tubing, or even a plain round tubing of 1⅛"x.035 wall, is satisfactory. After procuring the tubing make a full-size drawing of the frame on the shop floor and cut the pieces to the angles and lengths given, fitting them to the drawing as you go. After this is completed, build the two lower frame pieces. The base tube (11½") is spotted to the forward tube going up to the fork neck and also to the rear tube going to the rear wheel hangers. Three spreaders are required and these are cut 4" long from 1" o.d. .035 wall tubing; two of these are located between the lower frame sides and spotted into position as noted. The forward tubes are cut on the insides and bent together to form the V as shown in the bottom view, then welded. The upper rear tubes then are laid together and the third spreader is located 9¾" c.c. to the rear of the taper terminating point and welded into position. These tubes

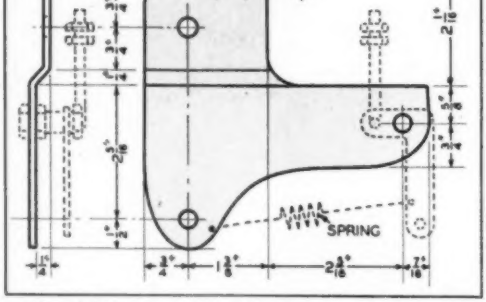

TOP VIEW
STREAMLINE TUBING, 035 WALL
.035 WALL TUBING
HANDLE BAR
DETAILS OF FRAME SIDE VIEW
FORK
WHEEL HANGERS C.R. STEEL
COUNTERSHAFT BEARING SUPPORT
MOTOR BASE PADS
FOOT REST
BOTTOM VIEW
1"-.035 WALL TUBING SPREADERS
WELD TO FRAME UPRIGHTS
MATE HOLES TO BEARING HOUSINGS
COUNTERSHAFT BEARING
TURN TO 1.180 THREAD LEFT HAND 24 T.P.I. MATE TO PULLEY
NUT C.R. STEEL 1 REQ.
PULLEY ADAPTER
COUNTERSHAFT C.R. STEEL
TAP 18 T.P.I.
DRIVE PULLEY CAST IRON 1 REQ.
DRIVE PULLEY 2 REQ. CAST IRON
THREAD LEFT HAND 24 T.P.I.
DRILL NO 12 SPANNER WRENCH HOLES
WELD
BEARING HOUSING
.065 WALL TUBING BRAZED TO PLATE
BRAKE BAND 18 GA STEEL 1 REQ.
RIVET
DRILL 3/16 HOLE
DRILL SPOKE HOLES NO 30 .128
REAR WHEEL HUB
TURN ENDS TO 1.180 THREAD LEFT HAND 24 T.P.I. MATE TO BRAKE DRUM AND PULLEY
LEFT HAND THREAD 24 T.P.I.
BRAKE DRUM C.R. STEEL 1 REQ.



Shape of frame is shown clearly in this side view.



The brake plate, shown in the diagram below, is installed as above. Brake band is anchored at bottom.



Slotted hole allows for adjustment of the drive belt.

are cut on the inside ½" forward of the spreader and bent to form the taper as shown in the top view. The forward tube is located and welded to the upper rear tubes. The lower frame now is set on the floor and the uprights located and spotted, the upper frame is placed into position on top and spotted, the frames are welded together at the rear wheel hangers and welding of the whole frame proceeds, work being carried forward and each section completed as it is reached.

Rear wheel hangers are cut out of $\frac{3}{16}$" cold rolled steel, cut long enough to extend inside the frame 1", and after joggling, they are inserted and leveled. It is important that the hangers are level, otherwise the Cycle will not balance; when level they are brazed in position. Before attaching the fork neck, it is necessary to procure the standard bicycle bearings and races that are used in the neck. A piece of 1½"x.125 wall tubing is cut 6½" long and each end is bored to take the races.

A line is drawn on the floor, the frame is placed level on the floor straddling the line and a plumb line is then dropped from the center line of the frame at the rear wheel hangers to the line. Another plumb bob is attached to the fork neck, and the fork neck is spotted into position while both bobs are on the line. Then the frame is brazed to the neck, making sure the frame is plumb. Engine supports are made of 1¾"x¾"x⅛" angle iron and located according to the engine used. Holes through these members for engine bolts should be slotted to permit adjust-

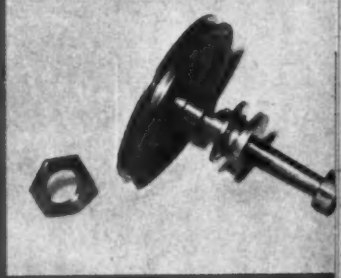
Shaft and engine pulleys have streamlined cover.

ment of the belt. Foot rests are cut to individual needs from 1"x.035 wall tubing and welded to the frame at an angle as shown. The frame is now complete except for seat-attaching lugs. An extra large bicycle seat is used and re-worked with the attachment for the seat neck removed. Pictures show the installation of the seat, but as seats vary, the attachment is left to the individual builder.

A standard bicycle fork replacement neck is used on the fork and this is purchased at a bicycle shop. Upper fork plates are cut from $\frac{3}{16}$" steel plate and rounded to fit the tubing used. Tubes are butted against the top plate and welded; the bottom plate is cut and placed between the tubes 1" below the top plate and this is also welded to the tubes. A 1" hole

A standard replacement neck is used on the steering fork. The fork arms are bent forward at a 22° angle.

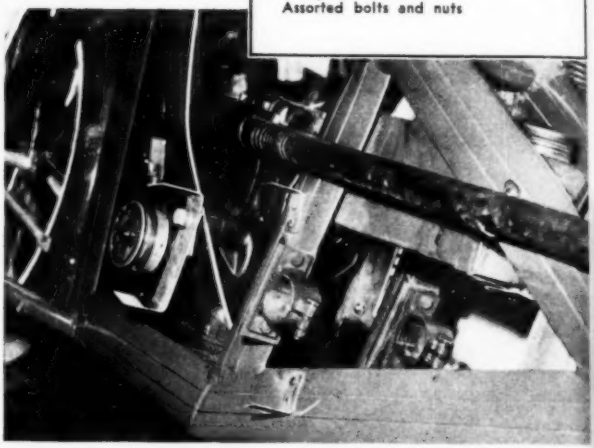
In the photos below are the brake plate with its band and arm, and details of the countershaft assembly.



LIST OF MATERIALS

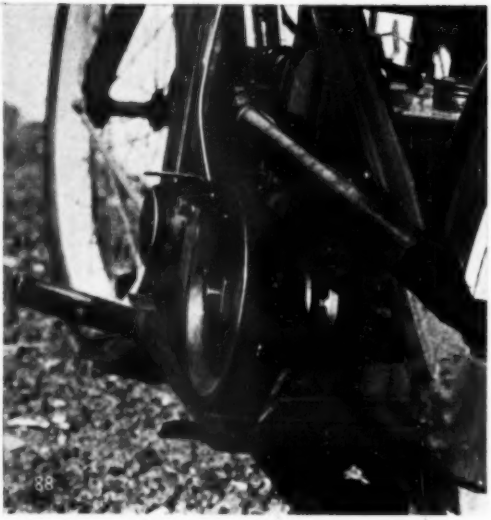
2—20 x 2.125 bicycle front wheels, tires and hubs
1—1" bicycle fork replacement neck
1—handle bar gooseneck
1—set bicycle fork bearings and races
1—fork retaining nut
1—fork retaining washer
1—bicycle handle bar, brake grip lever and cable
1—large bicycle seat
2—New Departure No. 5202 bearings
1—set 20 x 2.125 fenders and braces
2" of 1½ x .065 wall tubing
6½" of 1½" x .125 wall tubing
45" of 1" x .035 wall tubing
26' of 2½" x .035 wall streamline or round tubing
1—½" x 35½" V-belt
1—½" x 48" V-belt
24—⅛" motorcycle spokes and caps
1—⅓, ¾ or 1 h. p. engine
2—¾" x 6" cast-iron pulley blanks
1—¾" x 6" C.R. brake blank
1—C.R. steel strap, ¼" x 1" x 6"
1 piece 22-gauge steel, 14" x 36"
1 piece ⅛" C.R. steel, 12" x 12"
1 piece 18-gauge steel, 3" x 18"
1 piece C.R. steel plate, 12" x 12" x 3/16"
Assorted bolts and nuts

Throttle feed is mounted on handle bar; brake is on the opposite side.



Countershaft bearing supports are mounted to frame pieces as at right.

Photo below shows countershaft belt drive and location of exhaust pipe.



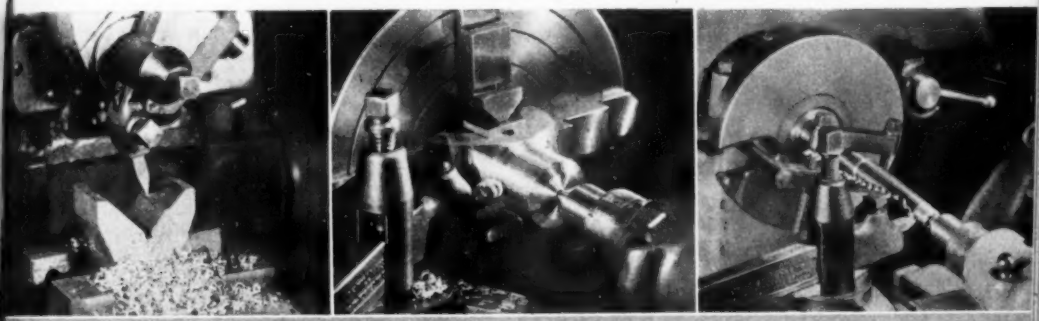
then is drilled through the center of both plates and the replacement neck slipped into these holes and welded on the lower side of the plates only. A ½" piece of material (triangular) is removed from both tubes as noted, then the tubes are bent up to an angle of 22° and welded. The front wheel hangers are then cut out and installed and the fork is complete. The handle bar is cut 23" long from 1"x.035 wall tubing and the bicycle gooseneck is located in the center of the tube before bending. It is important that the gooseneck be in position before bending the bar otherwise it will not slip on. The bar should be bent to measurements given.

Cold rolled steel rod $\frac{9}{16}$" o.d. 6⅜" long is used for the countershaft; chuck in the lathe and turn to measurements given. The .590 measurement should [*Continued on page* 132]

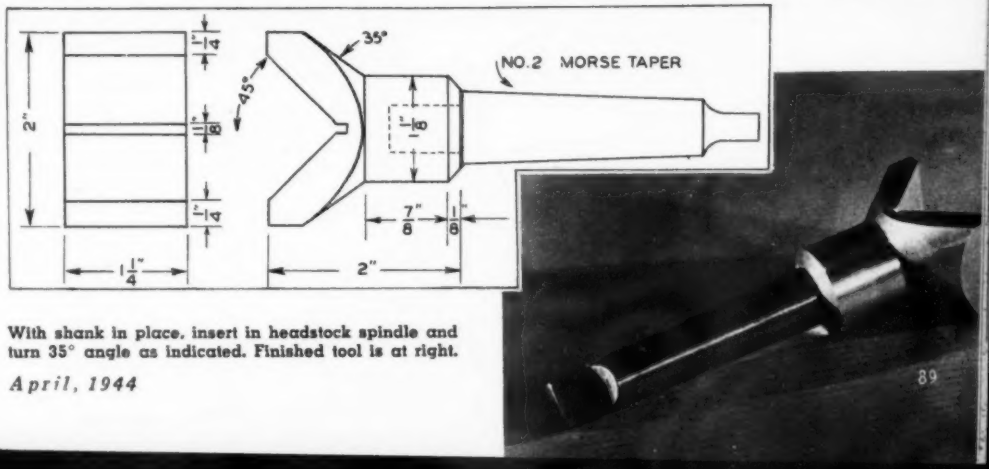
CROTCH CENTER

THIS crotch center is a great convenience and a very desirable accessory for a metal cutting lathe. Mounted in the tailstock, it centers round work for cross drilling, a hard job when a drill press is used with the work held in a vise.

It is made from a piece of scrap steel cut to the dimensions shown and having a taper shank taken from a broken twist drill. Saw the steel blank to size and cut the V with the shaper by alternately adjusting the head to 45° on each side of the center. Cut a slot in base of V with a parting tool for chip clearance, and then center the V-slot in the four-jaw chuck and turn the opposite end, drilling to receive the No. 2 Morse taper shank. Big end of shank is shouldered down for drive fit in V-block hole.—*C. W. Woodson.*

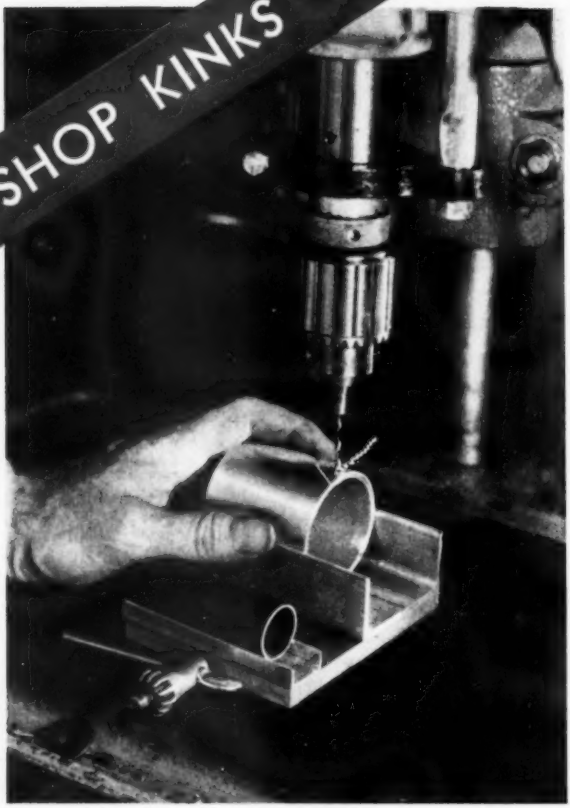


Shaping and drilling of block are shown above. If taper shank is not available, make one in your lathe.



With shank in place, insert in headstock spindle and turn 35° angle as indicated. Finished tool is at right.

SHOP KINKS



Try this little shop gadget once and you'll swear by it. The photo above shows how pieces of various sizes can be held for your drill press without slipping.

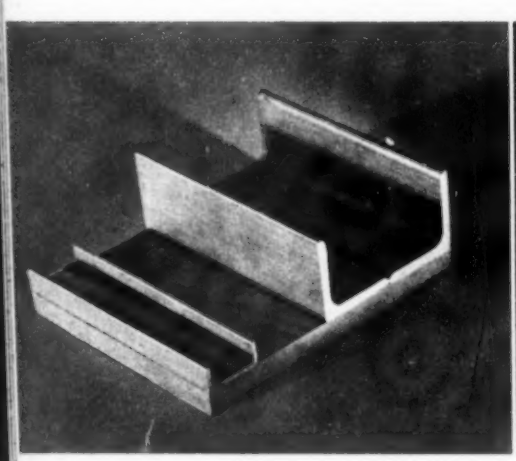
U-BLOCK

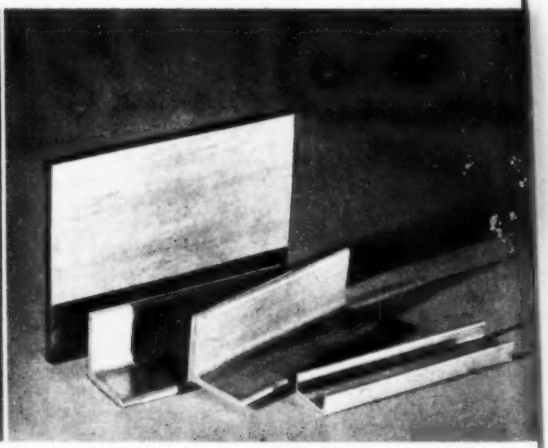
by C. W. Woodson

HAVE you ever had occasion to hold a piece of round work for laying out, prick punching or drilling? If you have, then you realize that a vise is not the tool for the job. Besides the fact that it can't hold long pieces satisfactorily, it will mar work of any length when tightened sufficiently to keep the work from turning. This U-block will prove to be one of the handiest little items in your shop for this purpose.

The block has two channels: one for work of large diameter and the other for smaller pieces. The base is 4"x5" and is made from a flat piece of cold-rolled steel. Several pieces of angle iron are welded or screw-fastened to one end to form the large support, while the smaller is made from a short length of channel iron attached to the other end in a similar manner.

To use, simply lay the work in one of the channels; friction will hold it in place and keep it from slipping during drilling. Long work can be supported conveniently by the U-block under one end and a table under the other.

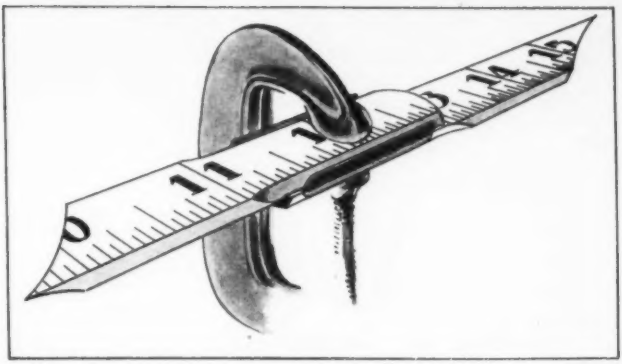


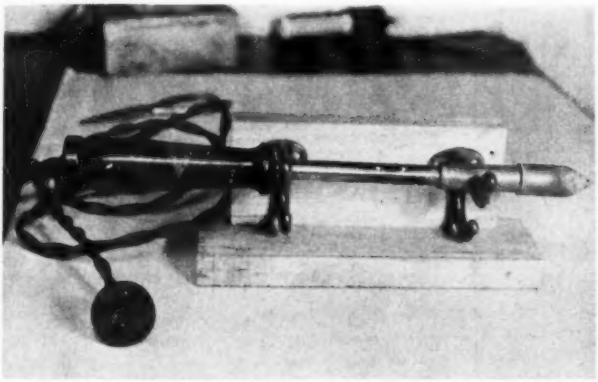


Here is the U-block which takes only a few minutes to make. Parts are shown in the photo at right.

An Old Rule

WHEN your folding rule becomes a bit the worse for wear and its joints loosen or wooden parts crack, get another rule which is also in poor condition and use parts from both to make one good rule. Pry off the old metal joint, hold the wooden pieces and new joint with a C-clamp and press the flanges together with a pair of pliers.



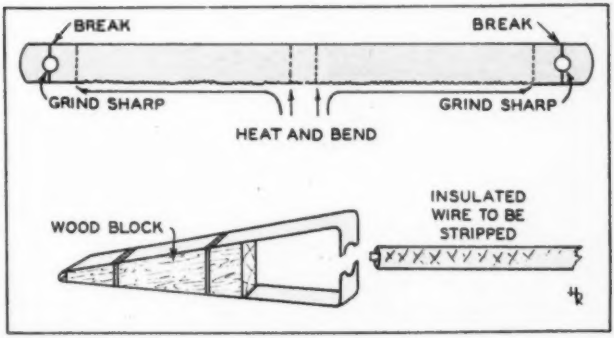


Rest For Iron

HERE is a tricky little rest for hot soldering irons; one you can throw together in no time. Two coat hangers are mounted on a piece of 1" stock which, in turn, is mounted on a baseboard. The iron is placed across the hangers as shown. A feature of this rest is that the hot iron contacts the metal parts in only two places, preventing too much loss of heat from the unit by conduction.

Stripping Wire

THIS handy tool for stripping insulation from wires is made from an old hack-saw blade. First break off both ends of the blade across the holes as shown and grind the rest of each hole to a cutting edge. Heat and bend the blade as indicated; reheat and quench to restore temper. Fasten to block with wire.

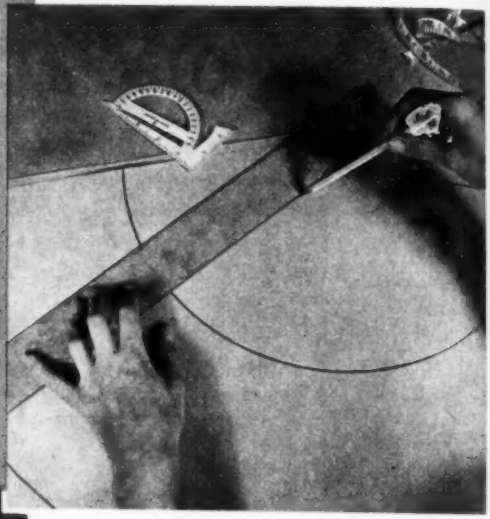


For Putty Cans

PUTTY left in a can will soon dry out unless the can lid is fastened securely. A few drops of oil, placed in the can lip groove before the top is put on, will assure a tight seal, filling in any small openings which still may exist between cover and lip.

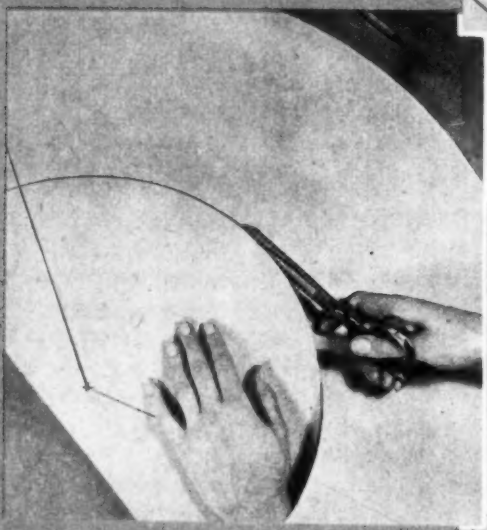
LAMP SHADE

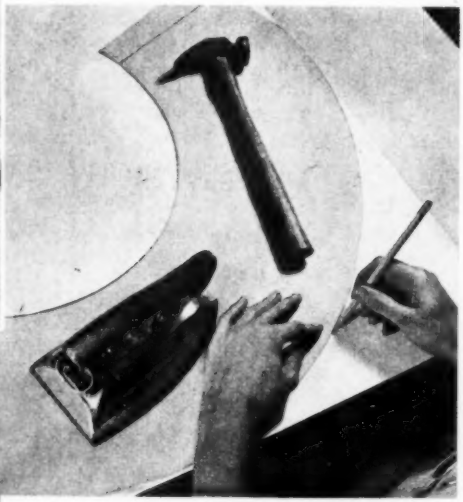
Finished shade rivals commercial designs.



On a piece of wrapping paper 20" x 35" lay out two concentric circles with radii of 8" and 18" respectively. With protractor mark 134° angle.

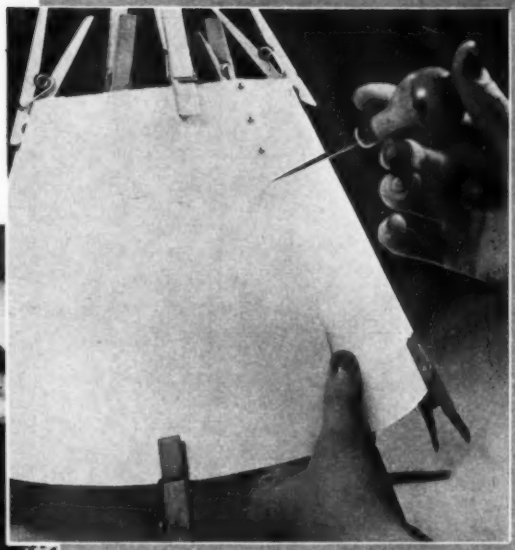
Cut out the arc you have drawn on the wrapping paper, leaving about 2" extra on each end. This will be the pattern you will use for the shade.



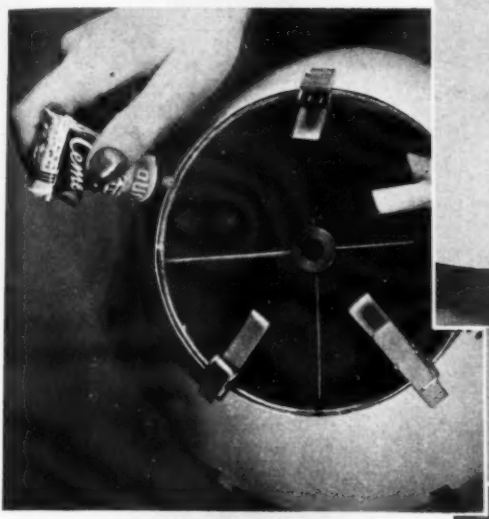


Place the paper pattern on a large piece of 1/64" white cardboard, trace its outlines and cut out carefully. Save pattern for additional shades. Use special care not to soil white surface.

VERY few materials and little skill are needed to make this attractive lamp shade. You will want some wrapping paper and cardboard, glue, prong fasteners, two circular wire frames 6″ and 12″ in diameter respectively, binding tape and wire to hold to the lamp.



Hold the edges of the cardboard to the circular wire frames with clothespins and cut ends to overlap about ½″. Fasten with prong fasteners.



Glue cardboard edges to wire frames and remove the clothespins. Note the wire attachment for holding the shade to frame; snap-on type can be used.

Sew silk binding around the rims, using large 1″ stitches; about 60″ of tape will be sufficient. Use thread of the same color. Then cut attractive designs from wallpaper and paste them on shade.

TEN COMMANDMENTS For Your Workshop

Suggestions for improving your hobby habits by an experienced woman machinist and tool-maker, author of "I Took A War Job."

by Josephine von Miklos

I. Try to form regular working habits. Study the way in which tools and materials are meant to be used; if you're not sure, ask, or look it up. Toolmakers, who are to ordinary handymen what Einstein is to the school boy, repeatedly say . . . that is, if they are *good* toolmakers . . . that they never know everything. So it's best not to assume that *you* do.

II. Keep yourself, your tools and your place of work clean. It is an accepted procedure in every machine shop to stop working five or ten minutes before quitting time to clean the machines, wipe the tools, put them away, take the workclothes off, etc. Caked oil and grease, sawdust and metal chips have a way of getting into the delicate parts of mechanisms, clogging them up. Also, cleanliness will prevent rust, the Number One enemy of tools. Need we mention what happens to paintbrushes if they are allowed to harden with paint left in them?

It's a hard life for a neglected paintbrush.

III. Keep your tools in order. Try to remember at all times that each tool has a definite place of its own, just as your books have their place, your kitchen utensils, your clothes. There is no reason on earth why your hammer should get less consideration than your favorite hat. As soon as you are through with a job, put your tools, your hardware, your material back where they belong. Doing this consistently will avoid mixed-up tools, loss, and harm, like scratching, loss of sharp edges, etc.

IV. Never, Never, NEVER, "slap" a job together, no matter what it is, how easy it may seem and, particularly, no matter how much in a hurry you think you are. As a matter of plain fact, a good worker is never in a hurry. His speed comes from co-ordination and knowledge. His accuracy is a result of experience. Much material and elbow grease

Put your tools to bed when you're through.

Neither slat nor fender could take it.

Keep your tools—and your friends.

This is one way to get rid of Xmas neckties.

are thrown out of the window if you hurry too much and ruin a job. If, in the beginning, you think a job over first, deliberately and carefully, then get the tools ready which you need for it, then think again before each step, you will get used to doing things right.

Too, if humanly possible, get into the habit of doing a repair job when you discover that repairs are needed, and not after damage is done. That is the economical way of doing things. A little while ago I saw that a slat on the door of our garage was loose. "I must fix that," I said to myself. Well, I was too tired that night, or too lazy to go and get the hammer and a few nails. I didn't do it, and never thought of that loose slat again until a week later when I clipped the slat with my rear fender and got good and stuck in the door. I HAD to get a hammer and nails then to be able to get into the garage; I also had to pay a handsome bill for having the fender straightened.

V. Lay your tools out BEFORE you begin a job. Have everything ready before you make your first cut, your first stroke with the brush, your first clang with the hammer. Don't rush back and forth for this tool and that one. Looking a job over should tell you just what you'll need for it. It is much like baking a cake. If you are a good cook you don't run to the icebox or kitchen cabinet for every pinch of ingredient.

VI. If you can possibly avoid it, don't borrow tools, nor lend them. It makes for better and more lasting friendship to use your own tools. You don't have to be nasty about not lending them; but there seems to be a good deal of sense in the old saying that one should neither borrow nor lend a tennis racket, a horse, or a wife. If you have the proper emotional relationship with your adjustable wrench, you don't want your neighbor to leave it under his garden hose. Nor will you misunderstand your neighbor if he wants to keep his wrench where it belongs.

VII. Safety is a very important factor in, a) good working habits, b) successful jobs, c) ultimate and continued satisfaction in your own well being [*Continued on page* 138]

Records and worksheets help a lot.

The scrap drive can use your junk.

Planning Your '44 V-GARDEN

by Andrew S. Wing, *Secretary-Manager National Victory Garden Institute*

LAST year, challenged by the possibility of the greatest food crisis in history, 20,000,000 American families rolled up their sleeves and planted Victory Gardens. As a result we have had plenty of food this winter for home use and the fighting men on all fronts as well as our gallant allies. Canned goods have recently been so plentiful that a few people, watching the points go down, have, like the grasshopper in the fable, questioned whether they should work a garden this summer or not.

The answer to these slightly disillusioned persons is that they *mustn't* be fooled by any temporary signs of a food surplus, for this is more apparent than real. Food officials in Washington and authorities everywhere are really concerned about the needs for food that lie just ahead, after the invasion starts. The prudent householder will, therefore, garden this year as ardently as in 1943 and on as extensive a scale as his facilities, time and energy permit.

Even if this were not the prudent as well as the patriotic course to follow, millions of Americans, having enjoyed for the first time the flavor and quality of garden-fresh vegetables, would undoubtedly plant a food garden this year just to have their own good food for the table or for canning, freezing or drying.

Garden chairmen and leaders agree that certain lessons were learned last season that all can profit from, even experienced gardeners. Some plots were much too large, but more of them were too small to be given a profitable return on the time and supplies invested. At least 1,500 square feet, that is

PLAN NO.1
20x30-FT.
GARDEN
30" TOMATO PLANTS-{30 INCHES APART MEDIUM EARLY.
30" TOMATO PLANTS-{30 INCHES APART MEDIUM OR LATE.
30" 1/2 ROW YELLOW BUSH SQUASH- 1/2 ROW CURLED KALE OR MUSTARD.
18" GREEN SNAP BEANS
18" YELLOW SNAP BEANS { BUSH, OR POLE IF POLES ARE AVAILABLE.
18" BUSH LIMA BEANS.
18" EARLY BROCCOLI-FOLLOWED BY COSLETTUCE OR ENDIVE.
18" LEAF LETTUCE-FOLLOWED BY LATE BROCCOLI.
15" 1/2 ROW NEW ZEALAND SPINACH- 1/2 ROW SWISS CHARD.
15" EARLY BEETS- FOLLOWED BY LATE CARROTS.
15" EARLY CARROTS-PLANT RADISH SEED WITH CARROTS-FOLLOW WITH LATE BEET.
15" ONION SETS OR PLANTS FOLLOWED BY LATE TURNIPS FOR STORING.
15" BORDER OF COLORFUL ANNUAL FLOWERS-ZINNIAS MARIGOLDS.etc.
L.A. HAWKINS
Numbers indicate distance between rows

Above is a diagram of a chart for a typical small suburban garden that can be varied within certain limits according to space available, maintaining general proportions of plan.

about 30 by 50 feet, is recommended wherever it is possible. Many smaller plots yielded as much food as small families needed, when properly planned and tended. But if your own available plot is too small, too shady, full of tree roots, or if the soil is hopelessly poor, rocky, or wet, better look around for a suitable plot elsewhere. Perhaps there's a vacant lot nearby, a community garden, or a bit of land which a neighbor or a generous farmer or estate owner will share with you.

Many large and small industrial concerns, and even banks and other business firms are planning community gardens this summer for employees who have no land of their own. Plowing will be done free and in some cases lime, fertilizer, seeds and other supplies will be provided at a nominal price or even without cost. Fortunate is the gardener who has an old and fertile piece of ground to work—one that he has worked, for then he will know just how to handle it. Having found a good plot, the next thing to do is to make a plan, if it hasn't already been done. Lose no time in figuring exactly what you need in the way of seeds, tools and supplies. Then order them at once, for while there will be plenty of some things, shortages of others may develop. Remember that most forehanded gardeners will have already done so long before you read this.

Take a piece of paper or cardboard—a shirt filler will do—and mark off your garden boundaries to scale. Five or ten feet to an inch is a handy scale. Then decide which way the rows are to go. North and south is usually best, though if your plot gets mostly early morning or afternoon sun you may want to run the rows east and west. At least six hours of direct sunlight is necessary to mature most vegetable crops. Arrange the crops so that the tall ones won't shade the low growers.

Cabbage is a sturdy, big producer for the average V-garden. Here Mary Wood of Knoxville, Penna., does a little cultivating in her garden.

which means that corn and pole must go at the end of the garden away from the sun, an elemental point that many gardeners ignore.

Now make a note of the vegetables you want, taking into consideration these points:

1. Family likes and dislikes. (For instance, why plant turnips if they don't like them?)
2. Value from a food and vitamin standpoint.
3. Ease or difficulty of growing. (Summer squash is easy, melons are difficult).
4. Amount of space required. (Small plots should not be planted to crops requiring much space, such as corn and potatoes).
5. Both early and late varieties of such things as corn, beets, and different types of lettuce and beans are desirable if you have the space.

Take a new seed catalogue from a reliable house and go through it from beginning to end, reading variety descriptions and marking every spot that seems best suited for your purpose and needs. Then eliminate the ones that are doubtful. A packet of seed is enough for several plantings in the average garden. Don't buy pounds of seed, not even beans and corn, when packets are sufficient. Seed is too precious to buy more than you need. In the case of tomatoes, peppers, cabbage, broccoli and a few other things, it is usually better to buy plants rather than seed unless your garden is large and you have a hotbed or coldframe in which to start your plants indoors. But if you do buy plants *make sure* that they are good, named varieties from a reliable source. You can get an earlier start by buying sturdy, potgrown plants than by trying to nurse your own along in a skimpy window box. If you want to grow your own plants, get the proper equipment and start them the right way.

Here are some points to keep in mind in making up your list: Tomatoes probably pay better than any other crop so have from five to ten plants for each member of the family, depending on how much canning you are planning to do. Quality and disease resistance are more important than super size. Marglobe, Rutgers and Scarlet Topper are better sorts for the home garden than Ponderosa, Beefsteak or Oxheart, but have a few of those too and some of the small-fruited varieties if you like them. Since tomato plants are not set out until the nights are fairly warm, the rows can be planted with early crops such as radishes and lettuce, which may be thinned out to make room for the tomatoes. Fifty tomato plants require 100 feet of row.

Beans probably rank next to tomatoes in value from food standpoint and almost everyone likes them. Pole varieties will give you a larger yield but mature later, also they last longer if you keep the bean beetles away. If you have the poles, I suggest both bush and pole snap beans, of a stringless sort such as Tendergreen (bush) and Kentucky Wonder (pole). Lima beans are delicious but more difficult, therefore optional.

Plant several varieties of lettuce: loose leaf, loose head, and Cos or Romaine. Plant short bits of row at intervals of a week or ten days, rather than long rows that will mature all at

one time and go to seed wasted.

Make at least two or three plantings of carrots but at intervals so that there will be tender ones coming on through the season and some left over for storage. The same principle applies to beets but here use a large late variety for storage such as Winter Keeper.

When it comes to the green and leafy vegetables that are rich in vitamins such as spinach, New Zealand spinach, Swiss chard, mustard, turnip greens, collards and kale, be sure your family will eat them before ordering the seed. All are good if you like them but some people don't. Ordinary spinach runs to seed fast so have some other things to follow. Kale is valuable for fall as it will stand a deal of frost. Remember that even with such root crops as beets and turnips, the tops are richer in vitamins than are the roots of the plant.

Peas are difficult in some sections, and one rarely gets more than one good picking. The tall varieties yield better than the dwarf sorts but must have brush or wire to cling to. I seldom plant them for the above reasons, but they [*Continued on page* 136]

Don't start digging until the earth is dry enough to work. Damp earth clings to the shovel and weighs down your feet. Six inches is deep enough to work the soil for the average home V-garden.

SIX "DONT'S" FOR V-GARDENERS

Don't attempt a garden in unsuitable soil. Test it before putting in time and expense.

Don't grow big-area crops, such as corn or potatoes, in a small plot.

Don't fail to have adequate spraying or dusting equipment on hand.

Don't ignore early evidences of insect attack. Blitz 'em before they get a real "beachhead" established.

Don't (on the other hand) over-apply insecticides or the plants may suffer too.

Don't accept advice from everybody. There are as many "tinkering" gardeners as mechanics. Follow orthodox methods.

PLAN No. 2 FOR A LARGE GARDEN

	100 FEET →	North or East Side
36" Apart	SWEET CORN	Early planting—in drills
36" Apart	SWEET CORN	Second planting—in drills
27" Apart	½ Row CABBAGE	½ Row BUSH SQUASH ½ Row CUCUMBERS
30" Apart	10 Plants MED. EARLY TOMATOES	10 Plants LATE TOMATOES
20" Apart	12 Plants SWEET PEPPER	24 EGG PLANTS 12 HOT PEPPERS
24" Apart	½ Row EARLY BROCCOLI	½ Row SNAP BEANS
18" Apart	EDIBLE SOY BEANS	BANDEI Variety
18" Apart	BUSH LIMA BEANS	BUSH LIMA BEANS
18" Apart	½ Row CURLED KALE	½ Row PARSNIP
18" Apart	½ Row SWISS CHARD	½ Row NEW ZEALAND SPINACH
18" Apart	EARLY TURNIP	followed by LATE BROCCOLI
18" Apart	½ Row LOOSE LEAF LETTUCE	½ Row COS LETTUCE
18" Apart	LATE BEETS for storage	EARLY RADISHES with BEETS
18" Apart	EARLY BEETS with RADISHES	followed by SNAP BEANS
18" Apart	LATE CARROTS for storage	LATE CARROTS
18" Apart	EARLY CARROTS	followed by ½ Row LETTUCE ½ Row ENDIVE
18" Apart	ONION SETS or plants	followed by LATE TURNIPS for storage
12" Apart	Border LOW ANNUALS	PARSLEY, CHIVES, ETC.

↓ 30 FEET

Here's the plan you'll want for a large garden

DRAFTING OUTFIT

Drawing or retouching can be done with equal facility on this board-easel.

by L. R. Luttrell

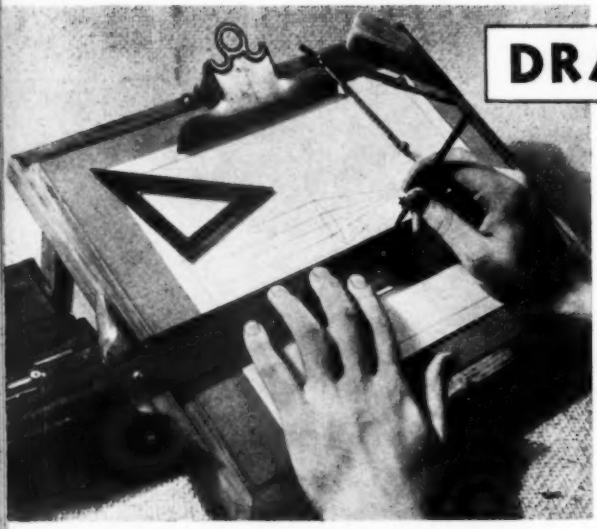


Fig. 1: Drawing board in use. Note handy size for small drawings and paper clamp holding drawing. T-square was made from old celluloid-edged ruler.

HOME craftsmen, photographers and students will appreciate the features of this portable drawing board and retouching easel. It is made in a handy size for carrying and features a storage space for drawing supplies, a paper clamp which eliminates the use of thumbtacks or gum tape for holding paper, and a working surface that rests at a comfortable slant, promoting good vision of work and holding hand at a restful angle for drawing and retouching. The size is small; but it is large enough to take 8½"x11" sheets, which is adequate for most home workshop drawings. It is especially useful to the student for notebook drawings. For the photographer, it is an efficient negative retouching stand, as well as an excellent working surface for spotting or coloring prints and making sketches of purposed photographic compositions.

Construction of the board is simple and requires only simple tools and materials. Fig. 2 is a drawing of the essential parts showing construction details. You will need the following materials for construction:

5 ft. of moulding, shaped like part 1 in circle C, Fig. 2.
About 2 sq. ft. of ¼" plywood, masonite, or thin lumber.
1—10½"x13½" piece of ⅝" soft fiber insulating board.
1—10½"x13½" piece of 1/16" cork sheeting. (This can be bought in form of table-place mat at dime or department store.)

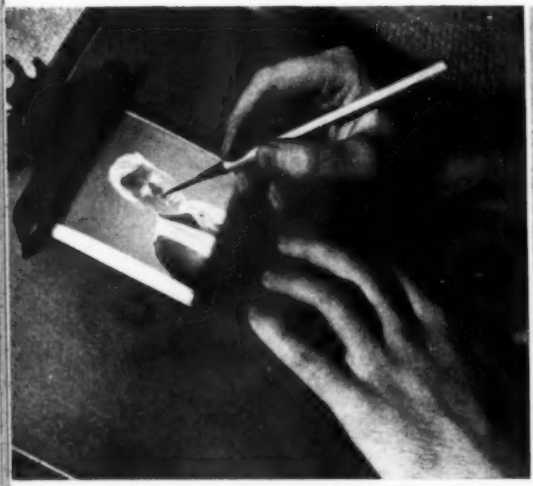


Fig. 3: By placing a small light bulb under opal glass opening you have retouching easel for negatives.

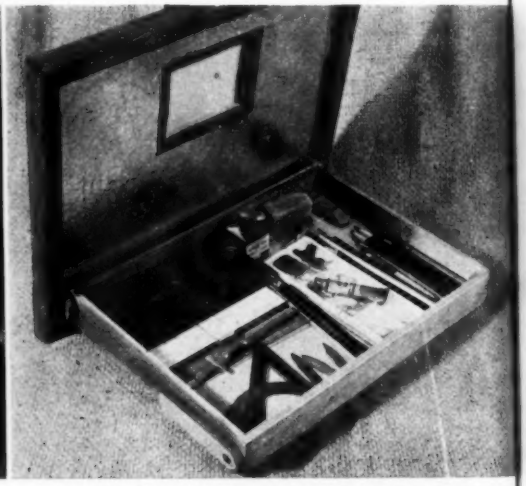
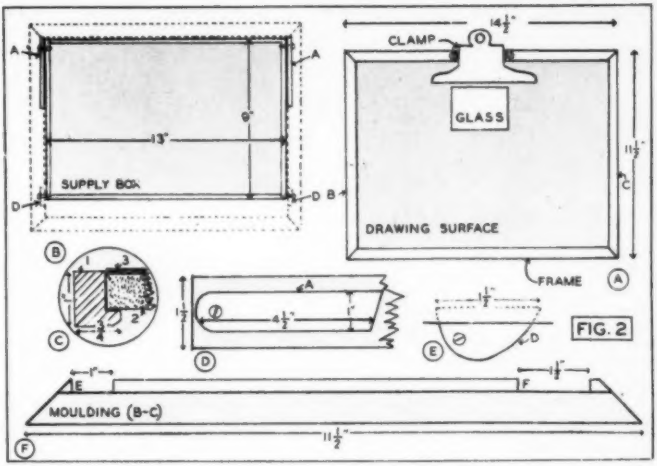


Fig. 4: Base of board forms space for holding drawing and retouching supplies. With cover closed it's portable.

1—Spring paper clamp. (From delivery man's billing board.)
Small piece of opal glass for retouching surface.



In describing construction, reference to parts will be made by using key letters and figures on drawings and photographs. The same key for designating a part is used on both drawings and photographs.

To begin construction, make a frame from the moulding as illustrated in (A) on drawing, Fig. 2. The finished outside measurements of the frame are 14½"x11½". This frame should be carefully mitered then nailed and glued together so its edges are exactly squared, for the frame forms the guides for "T" square in drawing. Inside edge of the two end pieces of moulding (b & c) should be notched at (e & f) as detailed in (F). The purpose of these notches will be described later.

The drawing surface is made by gluing the sheet of cork matting to the soft insulation board and gluing the combination into the frame. A cross-section detail of this construction is shown at (C) on Fig. 2. Part 1 is the moulding forming frame. No. 2 is ⅝" insulating board and 3 is a fine textured cork mat which forms a resilient drawing surface. This will retain a smooth surface by absorbing minor cuts or scratches better than a hard surface.

If you are going to make a retouching stand, as well as a drawing board, you will next cut out a section of drawing surface down through the insulating board; and countersink the piece of opal glass into the opening. The glass must be absolutely flush with drawing surface. Cut opening for glass just below position of paper clamp as shown at (A) Fig. 2. If there are any cracks along edges of the glass fill them carefully with "plastic wood" and sand lightly to make absolutely smooth drawing surface.

The next step is to install the paper clamp. This clamp is screwed to one edge of the drawing board frame as illustrated in drawing and photos. Paper for drawing or negative to be retouched is held by this clamp; and it is one of the handiest features of the board.

Now comes the construction of the supply space. This is simply a shallow coverless box, 9"x13" with 1½" sidewalls. It is made of ¼" plywood or similar material. "B" on the drawing illustrates this part; Fig. 4 is a photograph of it filled with supplies. The dotted outline in (B) shows position of drawing surface which forms a cover over this supply box.

The two remaining parts are the hinges for attaching drawing board to supply box, and the folding supporting braces to hold board at slant. Both are made of ¼" plywood or lumber. "E" of Fig. 2 is detail of shape of these hinges and their key is (d) in illustrations. They are glued in place on inside of frame in notch (f) on lower [*Continued on page* 136]

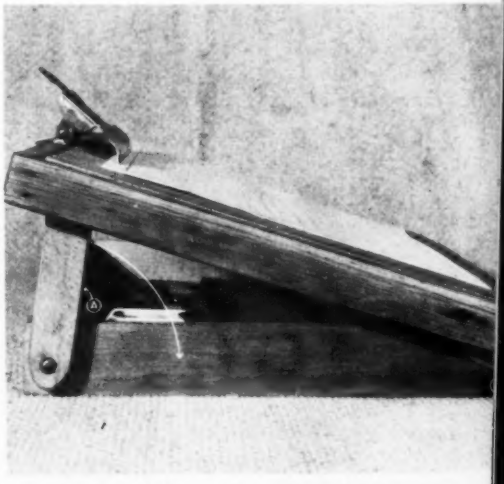


Fig. 5: Details of hinge and arm which supports drawing surface at slant. Arrow shows fold direction.

THE SCHOOL SHOP

Conducted by Gilbert Paust

Lieutenant, Civil Air Patrol, Westchester Squadron

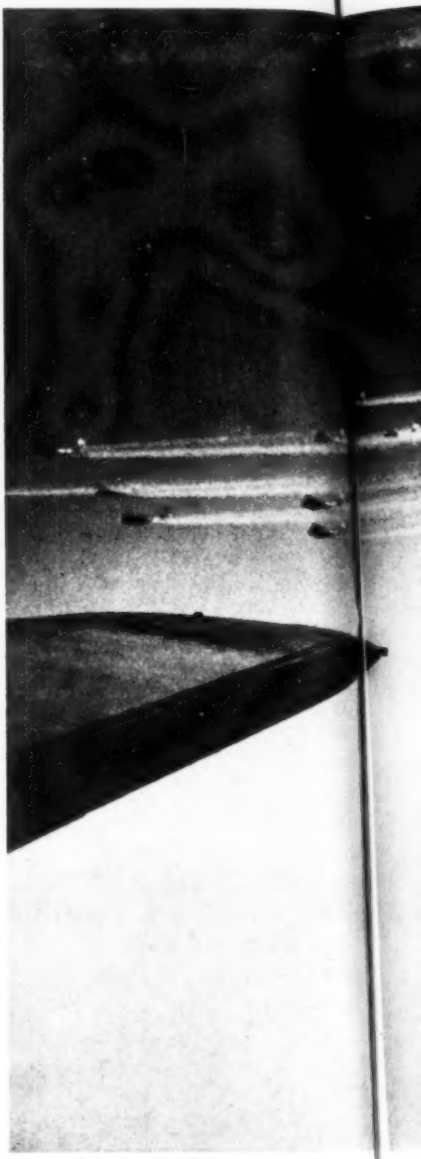
Lesson 14—How Temperature Makes Weather

WE MENTIONED in the last lesson that temperature and pressure are chiefly responsible for the atmospheric conditions which we call *weather*. Temperature is probably the most important of these two since it has a direct effect upon pressure as well as upon the various elements of the atmosphere, and so we shall make it the topic for our first consideration.

In our study of the air which blankets old Mother Earth, we found that one of its constituents is a substance called *water vapor* which is present in the atmosphere in very small quantities. The original source of this water vapor is the earth itself, for there is a continual exchange of moisture between the earth and air. During the day the sun directs its hot rays upon our planet's surface, raising its temperature and causing its moisture to change from a liquid to a gas or vapor, a process we call evaporation. The air absorbs this vapor, and, when it cools by processes we shall mention later, it condenses the vapor in the form of clouds, fog or precipitation.

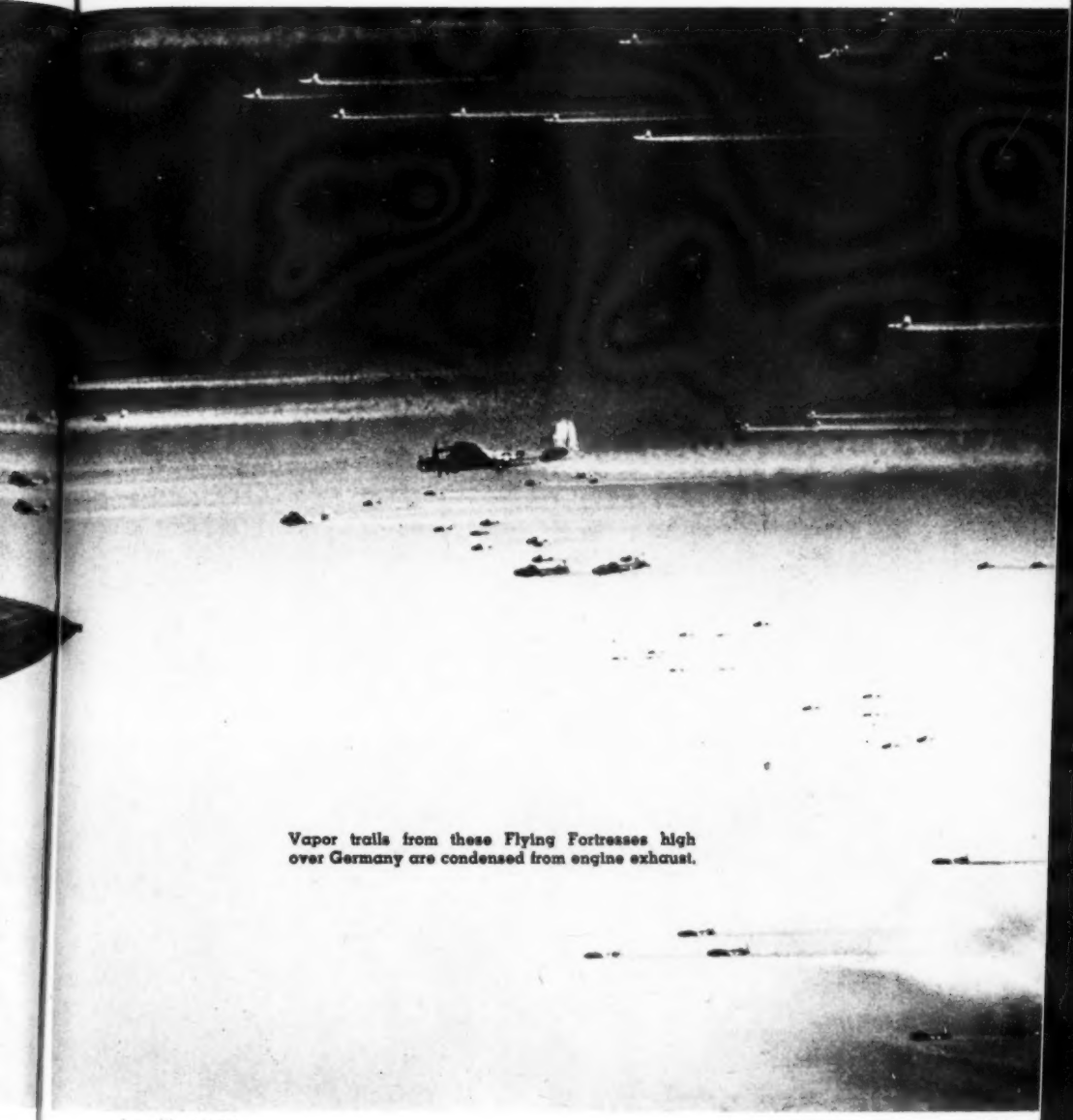
Air changes its volume with temperature change; it expands when the temperature rises and contracts when the temperature falls. Moreover, it holds its water vapor in the same way a sponge holds water. Let's suppose that we have a sponge which has just soaked up about a cupful of water. As we squeeze it in our hands, what happens? It reduces in volume until finally the water begins to drip from it. Air behaves in much the same way; in this case the contraction with temperature fall corresponding to our squeezing. The compression point or temperature at which the air will begin to squeeze out or condense its moisture is called the *dew point*.

By *humidity* is meant the amount of moisture in the air. Let us say that our sponge is capable of holding 3 cupfuls of water, but that we have given it only 1 cupful to hold. With 3 cupfuls it will be saturated, but with only 1 cupful it will be ⅓ saturated. If our air is capable of holding a certain quantity of water vapor, but is actually holding only ⅓ that amount, it also is said to be ⅓ saturated or 33⅓% saturated or to have a *relative humidity* of 33⅓%. In other words, relative humidity is the per-cent saturation of the air. Air com-

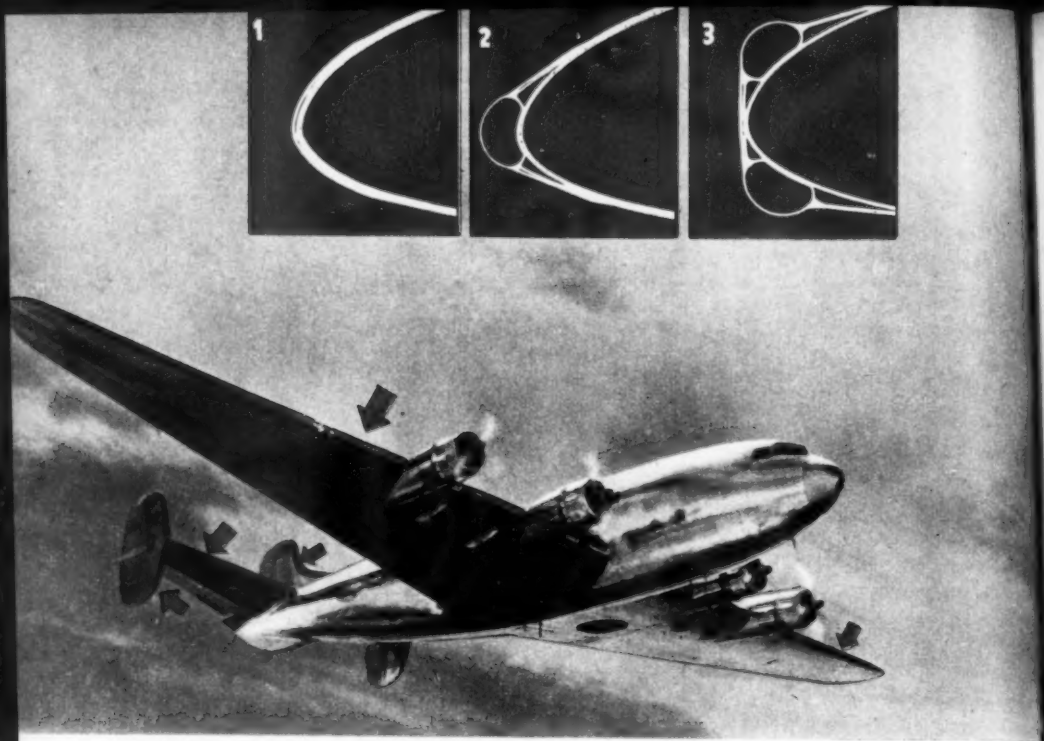


pletely saturated will have a relative humidity of 100%. When ½ saturated, its relative humidity will be 50%. From this discussion we can see that whenever clouds, fog or dew are forming, the air in their vicinity must be at the dew point and its relative humidity must be 100%.

Now let us see how these temperature changes occur in the atmosphere. In gases of all kinds, heat is transmitted by a process called *convection*, which really means moving currents of the gas itself. In the air, then, temperature changes occur when moving currents of air are present or when masses of air at different temperatures mingle. There is another important process by which air temperatures can increase or decrease. When a gas expands its temperature drops, and

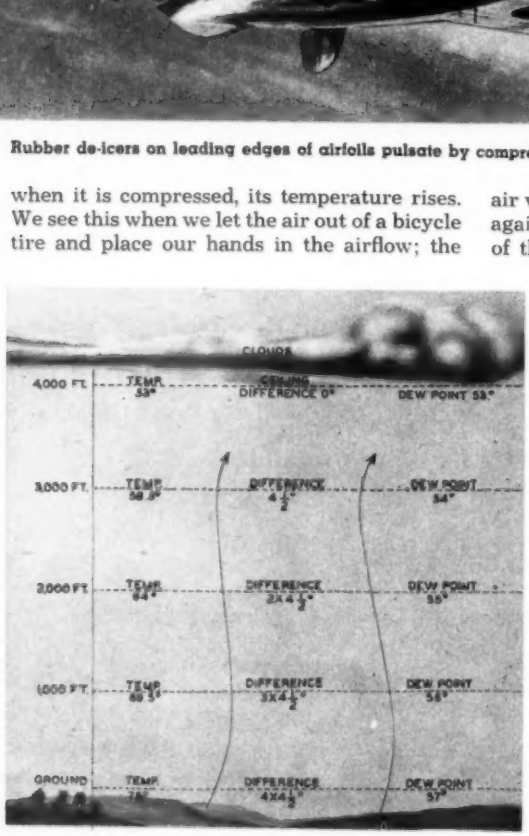


Vapor trails from these Flying Fortresses high over Germany are condensed from engine exhaust.



Rubber de-icers on leading edges of airfoils pulsate by compressed air and break off rime ice which may form.

when it is compressed, its temperature rises. We see this when we let the air out of a bicycle tire and place our hands in the airflow; the air will feel cool. When we pump up our tire again with a hand pump, however, the barrel of the pump will feel hot because of the air compressed within it. To summarize, we have two methods of cooling air to the dew point: first by mixing with it a much cooler mass or current of air,



At left, temperature and dew point differ by 4x4½; this will mean a 4,000-ft. ceiling.

Advection fog formation is shown above.

Mechanix Illustrated Art by Hy Rothstein

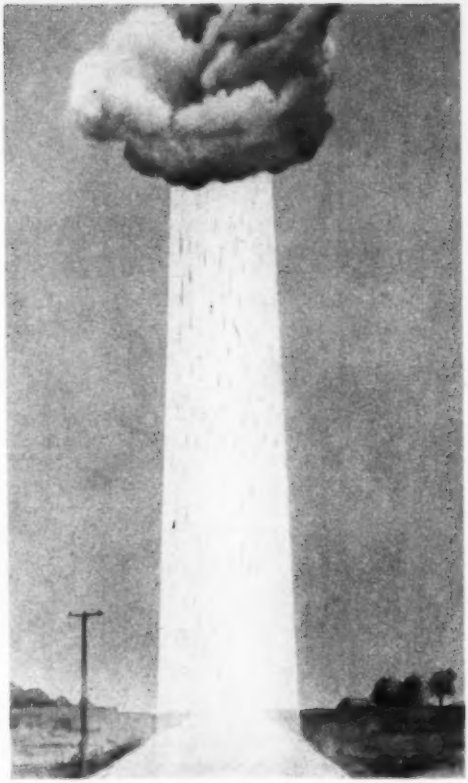
Photo Courtesy Jam Handy Organization

Hygrometer measures humidity; uses human hair.

and secondly by expanding the air to drop its temperature. Do not confuse this second method of cooling air to the dew point with the squeezing method we discussed previously. Here we are expanding air to cool it; in the other case we were cooling air to contract it. Even though our air is expanding instead of contracting in this instance, it still will squeeze out its moisture because of the fact that its temperature has dropped to the dew point and there is no longer room within it for water vapor particles at this temperature. Now for the relationship between these two and weather.

Certain portions of the earth's surface, such as roadways and plowed fields, absorb more of the sun's heat than do others. These heat the air which comes in contact with them and create ascending air currents or *thermals*. As these thermals rise into regions of reduced pressure (remember pressure decreases with altitude) they expand and their temperature drops. When this temperature has reached the dew point, condensation will occur and clouds will form; this altitude at which the temperature and dew point are equal is the cloud ceiling. Sometimes entire layers of air can be lifted to higher altitudes by colder, heavier layers digging underneath them and displacing them. Currents of air, also, can be blown up mountain slopes by the wind and cooled in the same way.

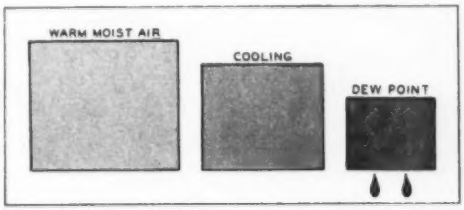
We saw in our last lesson that temperature decreases with altitude. When the air is stable and *is not rising*, this temperature decrease is 3½° F. per 1,000 ft. This is called the *normal lapse rate*. For example, if we should decide to take our plane up for a hop on a day when the air is not rising and its temperature on the ground is 46° F., at 4,000 ft. our thermometer (should we bring one with us) would indicate a freezing temperature (32°F.). How is this determined?



Thermal currents from hot earth form cumulus clouds.

Between the ground temperature and the freezing temperature we have, in this case, 14° (46-32); if the temperature decreases at the rate of 3½° per 1,000 ft., we would have to ascend to 4,000 ft. for the temperature to drop 14° (14÷3½).

When air is rising, however, clouds form and the following is the manner in which cloud ceilings can be calculated. Rising air cools at the rate of 5½°F. per 1,000 ft. This is called the *dry adiabatic lapse rate*. The dew point of rising [*Continued on page* 138]



Air, cooled to the dew point, squeezes out and condenses its water vapor.

IDEAS FOR SERVICE MEN

ATTENTION GIRLS! Do you want wings? Is your man in the Air Corps? Then in your next letter tell him about this little idea submitted by Sgt. W. J. Link of the Army Air Base at Casper, Wyoming, and you'll get them by return mail.

A pair of regulation silver wings and a small chain are all the materials he'll need to make this attractive keepsake for his wife or/and sweetheart. Tell him to break the snaps off the back of the wings first, then drill a small hole in each wingtip. Next, he bends the wing to fit the shapely curve of your wrist. Chain is attached to holes and the result is a neat wrist band. If he wants to give you a real fancy job he can polish the back of the wings with a "blitz" cloth and inscribe thereon your name or some tender sentiment.

Better send him your wrist measurement when you write. After all, a man can't remember *everything*.

ANOTHER SERGEANT gives us the second suggestion for this month, and it concerns his undershirt and maybe yours. He's James Stern, Fort Riley, Kan., and he's been troubled by what might be called "creeping dog tags." The dog tag chain had a habit of riding up his neck in the back, and he finally managed to keep it down by the simple expedient of sewing a button to the back of his undershirt about an inch below the edge. Chain is slipped over head and hooked under button. He'll be comfortable from now on unless the dog tag gets up enough strength to pull the whole undershirt up his back.

A REALLY SWELL IDEA comes from Pfc. Everal Jeannaire, Atlanta Ordnance Depot, Atlanta; Ga., and we'll let him tell about it in his own words:

"Here's my suggestion for helping some of my fellow soldiers, particularly those who,

like me, have left their basement workshops back home and miss the pleasant hours spent therein. It's a chance for you to make something really useful, at no cost.

"Materials needed are a .30 cal. shell and an old hacksaw blade. These are made into a handy little pocket knife that you'll find a thousand uses for. Remove the bullet and powder from the cartridge. Slot the back end of the bullet and solder the hacksaw blade into it, after grinding the latter down to a convenient blade-size to fit in the shell, sharpening and pointing it. The shell acts as a holder for the blade assembly thus formed, and that's all there is to it! To use the knife, pull out the bullet, turn it around and stick it back with the pointed end in."

"NEEDLE AND THREAD are a necessary part of every service man's pack. An empty paper match book serves excellently to keep both handy and easily accessible, and is much lighter and more compact than many metal containers on the market. The thread is wound around the open match book with the ends drawn through slits in the side. Needles are inserted in the base of the match book." (See sketch.)

The idea shown above was submitted by S/Sgt. Lloyd Eyrich, Milwaukee, Wis., and we think you'll agree it has its points. (Ouch!)

THE MOTHER of a boy in the army, Mrs. Joseph Boserman of Garnett, Kansas writes in about a "kink" her son uses to keep his overseas cap in good shape. After washing the cap he slips it over a stretcher made from a wire coat hanger, as shown. It dries smoothly without ironing, and the braid stays put.

"MIRROR, MIRROR on the wall, I like your backside best of all."

This might well be chanted by Pvt. Earl A. Spaulding, Fort McClellan, Ala., because he has a very special kind of looking glass, as we shall see. It's really two-faced, but in a nice way. In Private Spaulding's field artillery battalion the men are not allowed to leave their mirrors hanging on the wall, so he thought up an ingenious method to get around this ruling. He simply pasted a picture of his favorite girl on the back of the mirror, which is then turned with the reflecting side to the wall when not in use. The stunt has been officially OK'd.

THE HAWKER TYPHOON

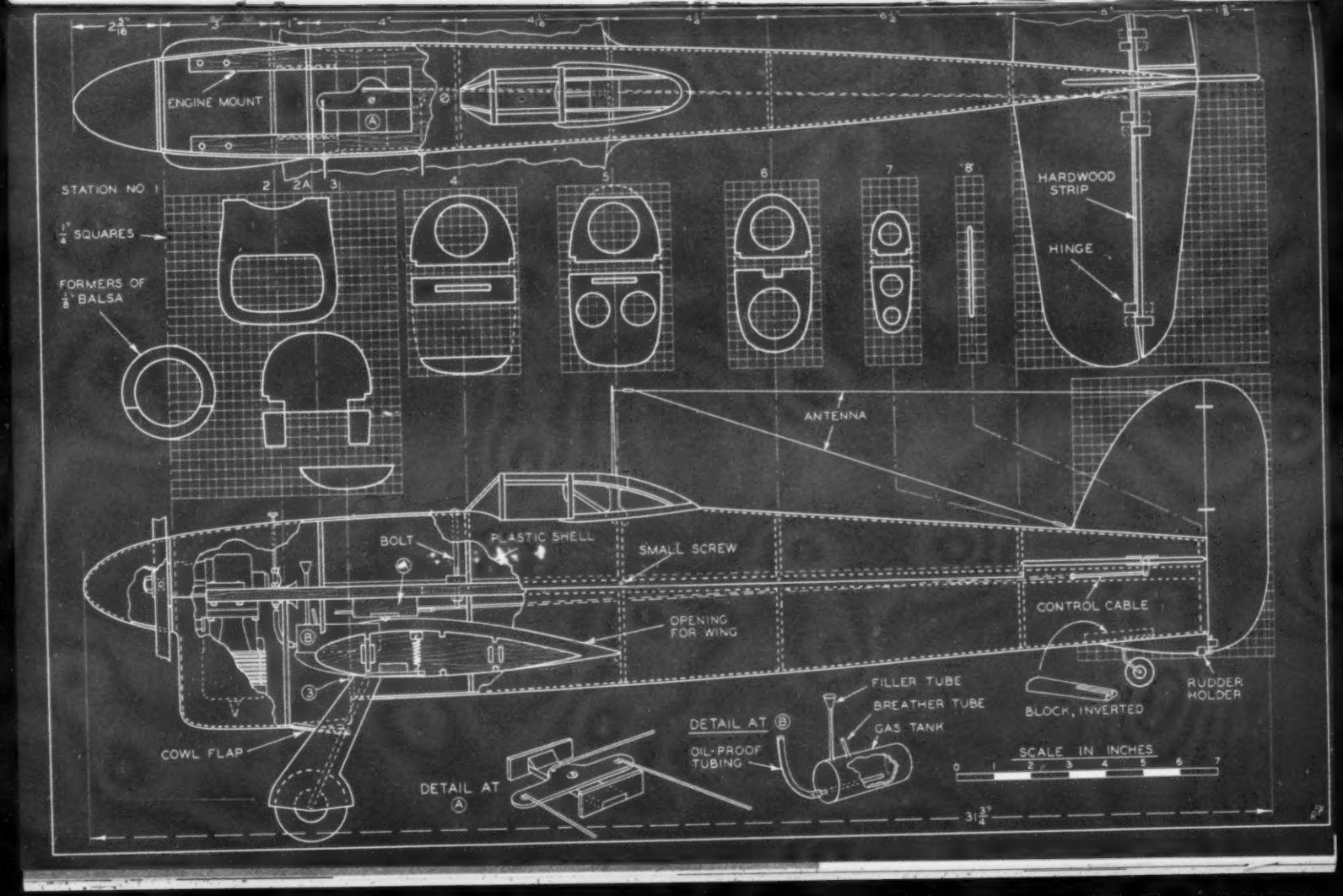
by Robert L. Brown

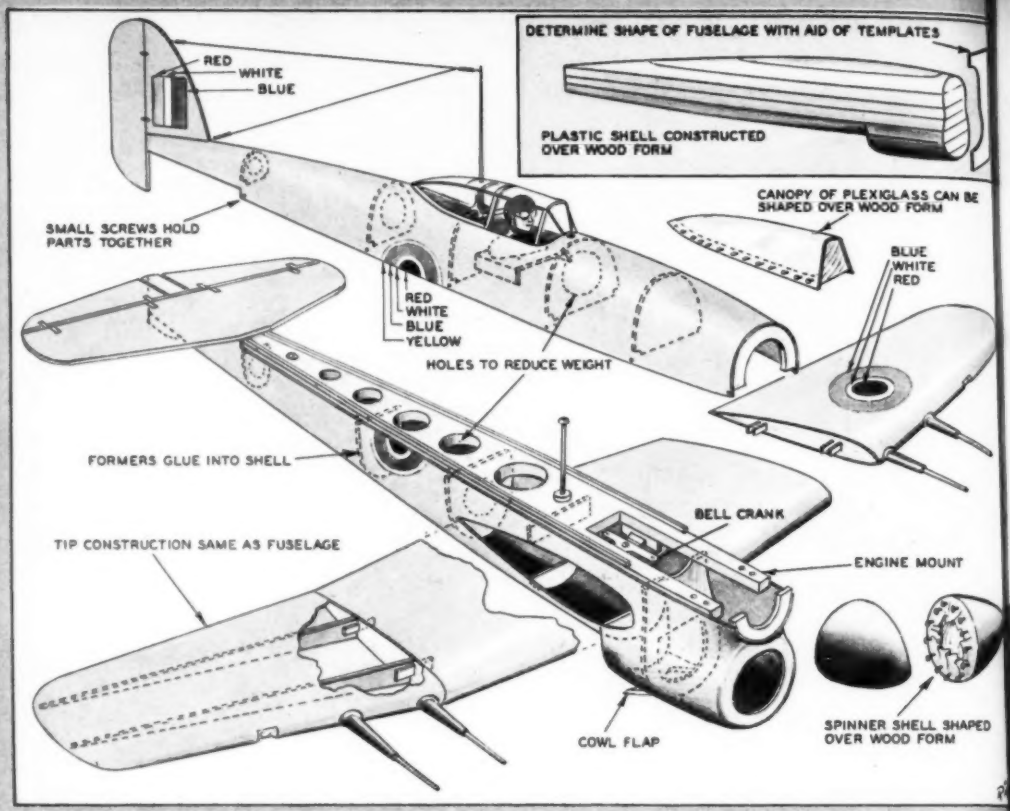
This model is patterned after one of the R.A.F.'s ace fighters. You'll like its realistic appearance.

THIS little plane is a replica of its big brother, the English *Typhoon,* which is proving to be a terror to Nazi fighters. Although a fairly recent addition to the R.A.F., this fighter already has knocked out scores of German locomotives and ground installations, besides getting its share of enemy aircraft. Its armament (and you can dress up your model accordingly) includes four 20-mm. Hispano cannons; some have twelve .303-cal. machine guns instead of cannon. The large scoop below the nose delivers air to the 2,400-h.p. Napier Sabre 24-cylinder engine.

Our model is 31¾" long with a 41¼" wing spread and features a new method of construction. The fuselage and wings are made of "plastic" shells, shaped from gauze and cascamite or Weldwood glue upon wooden formers. The fuselage is made in two pieces, the upper shell fitting snugly to the lower and held in place by a small screw. There's lots of room

Fuselage and wings have plastic-type construction.


ENGINE MOUNT
STATION NO. 1
1/4" SQUARES
FORMERS OF 1/8" BALSA
HARDWOOD STRIP
HINGE
ANTENNA
BOLT
PLASTIC SHELL
SMALL SCREW
OPENING FOR WING
CONTROL CABLE
RUDDER HOLDER
BLOCK, INVERTED
FILLER TUBE
BREATHER TUBE
GAS TANK
DETAIL AT (B)
OIL-PROOF TUBING
DETAIL AT (A)
COWL FLAP
SCALE IN INCHES
0 1 2 3 4 5 6 7



Drawing shows laminated construction of form for fuselage and method of assembling fuselage shells.

in it for U-control construction and for your class "C" engine. The wing depth is adequate to take retractable landing gear if desired.

Make the form for the fuselage from layers of hardwood as shown, determining its shape by means of templates cut from the former patterns. Use a draw knife for rough shaping and finish off with a whittling knife and plane. When completed, shellac or varnish the form and wax thoroughly.

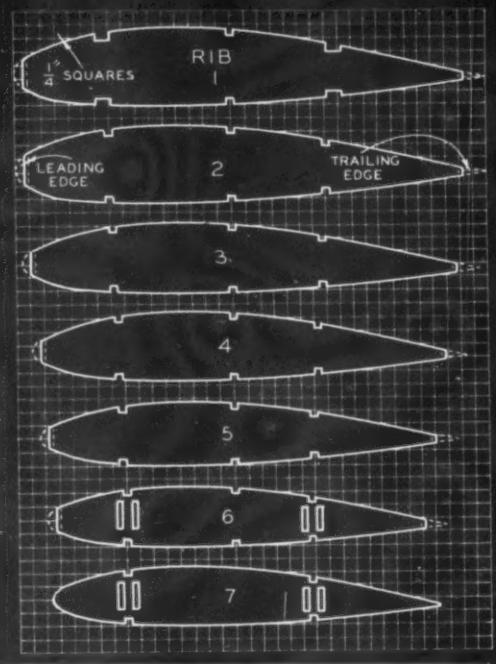
To make the shells, first cover the form with a layer of wet newspaper, making sure that no portion of the wood is left exposed. Next apply Weldwood glue to the paper-covered form and wrap with a layer of gauze. Repeat with glue and gauze until you have three layers, soaked well with glue. While wrapping the form, locate by means of pins the dividing line between two of its layers. If your shell, when completed, is cut along this line, it will be easier to loosen. After drying for three days, the shell must be sandpapered well and then may be removed. Use a razor blade or scriber to cut it at the division line previously mentioned. To break the shell from the form, drive a nail set into the form at the nose opening and strike the set

Here are some details you can add to your model.

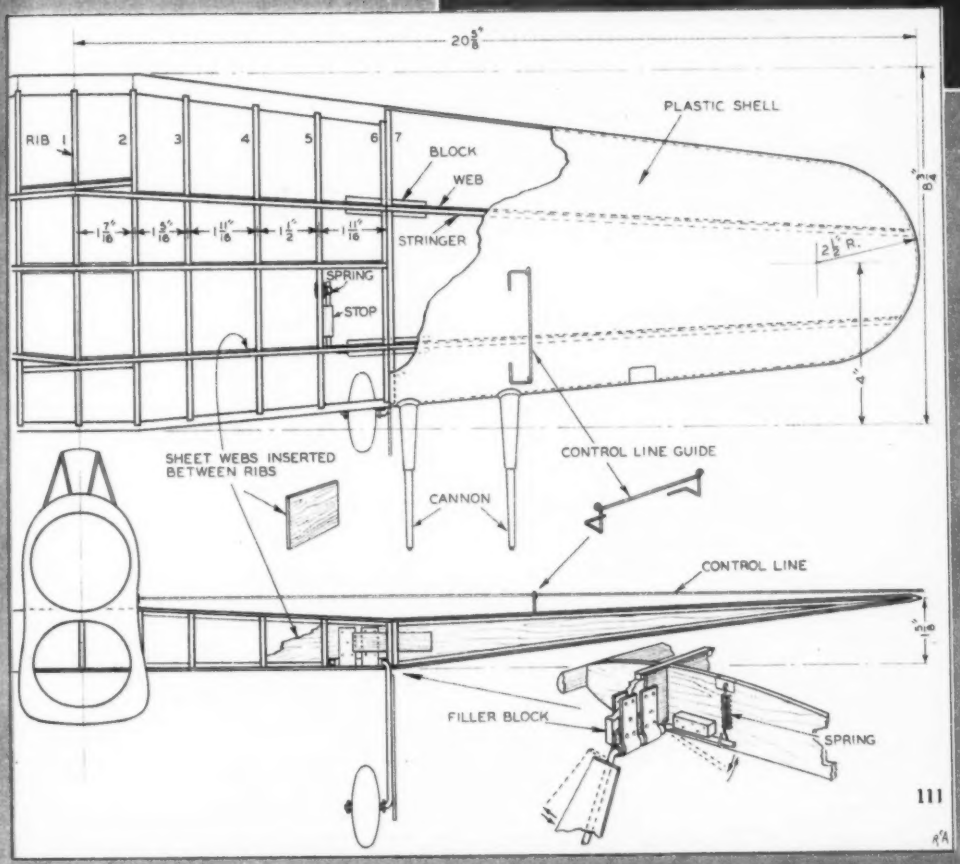
sharply with a hammer. A cooking spatula inserted between the shell and form will help.

Next glue the formers into the lower shell and fasten the tail wheel. A flat piece of balsa or hardwood $\frac{3}{16}$" thick is glued inside the top of the shell on the formers as indicated in the drawing. The engine will be mounted to the front of this section. Cut holes through it to reduce weight. Next the tail post is glued in place at the end of the shell and the small lower fin, which holds one end of the rudder, is fastened underneath. Cutouts in the sides of the shell for the wing section must be made carefully.

The form for the nose spinner is turned in a lathe and is made in the same manner as the fuselage. In wrapping, tack and glue the ends of the gauze to the back of the spinner. The shell is [*Continued on page* 134]



Wing centers are frame; tips are plastic.



HOW TO CARVE A PROP

Particularly important to the gas model propeller is perfect balance. This bubble-level balancing outfit does it on razor edges, assuring accuracy.

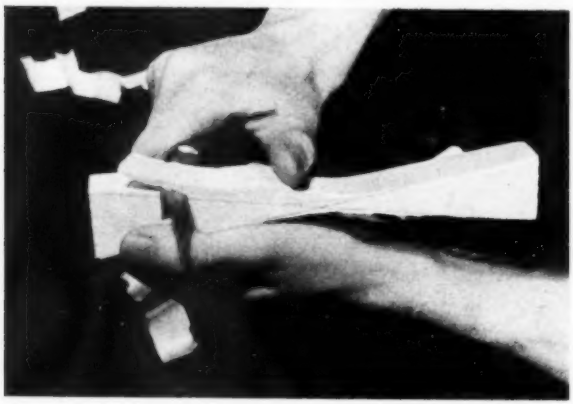
MODEL plane propellers aren't as hard to make as many model builders think. There are a few things to remember when planning a prop. Make the diameter as big as you can—and still have the prop fit the plane.

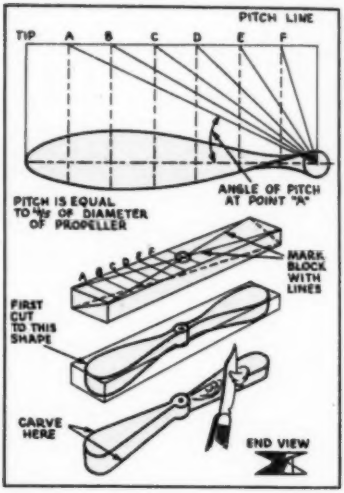
Large diameter, slow speed props are best, but if it's to be used on a gas engine, it will have to be made to suit the engine, as powerplants of this type develop their maximum power at high speeds.

For rubber-powered jobs you can use big, slow props with great success. Balsa props last longer if doped, and harder wood props such as those used on gas jobs, are best varnished.

Carve carefully, both to turn out a good job, and to protect your fingers. Modellers who carve nu-

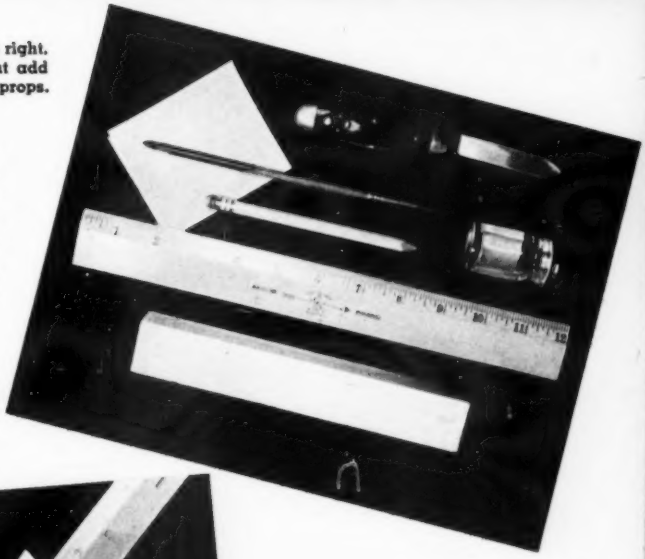
The first step in the propeller carving job is shown above. Draw diagonal lines across propeller block with soft pencil, then sketch in slight extra width for hub. Next, carve out shape as below—and be careful. Don't cut fingers. This is the way it's done with balsa.





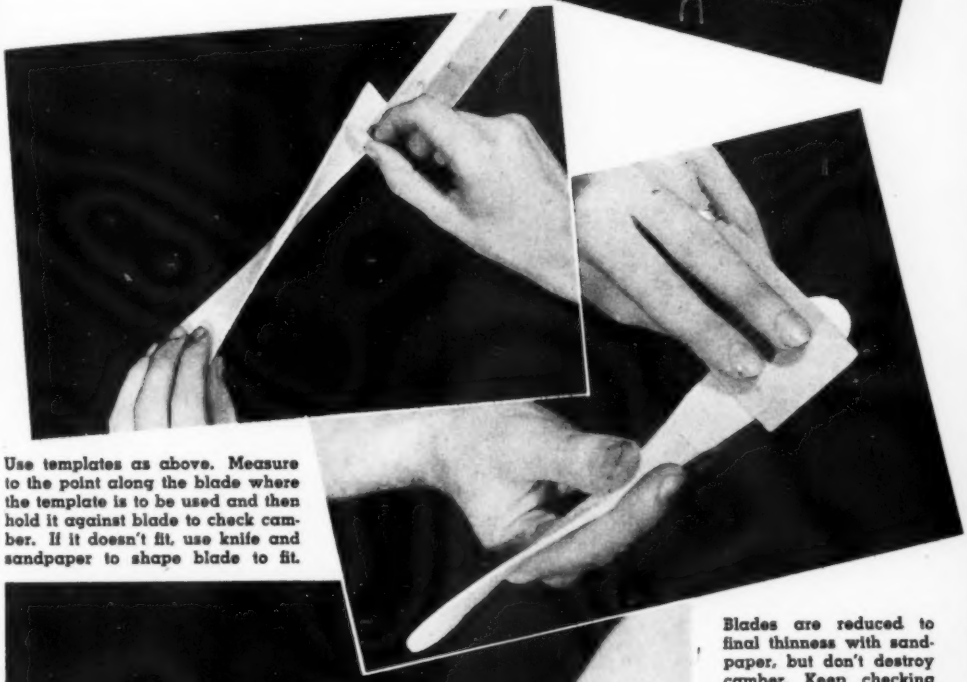
As the tip of a propeller travels over a greater distance in one revolution than does a point nearer the center, the angle at which it "slides" forward through the air must be less than the inner points. This diagram shows how these angles vary along the blade. If you carve the block to the correct shape, however, the pitch angles along the blades will come out right automatically. The pitch of any propeller usually should be about 4/5 the diameter. A 5-inch diam. prop, for example, would have a 4-inch pitch.

Tools and materials needed are shown at right. The dope and brush may be omitted, but add strength and smoothness to the finished props.



merous propellers often develop a technique of bracing one thumb against the other to control the knife blade—next time you go to the dentist, notice how he braces his fingers when using drills, etc. The object is to prevent slips. It works in propeller carving too—and you don't feel it as much.

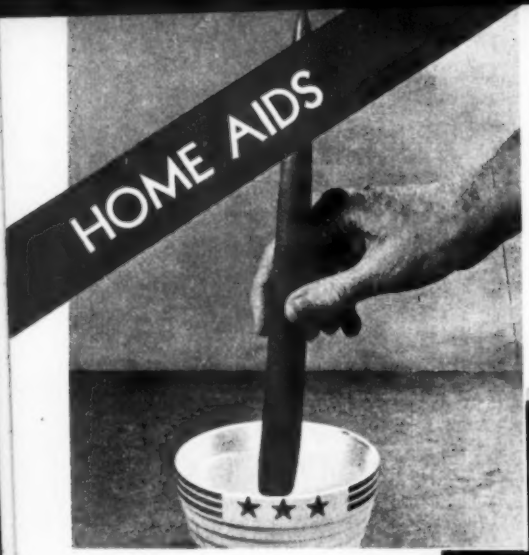
You can avoid the boner of "reversed blades" by remembering to carve always on the right hand side of the block.



Use templates as above. Measure to the point along the blade where the template is to be used and then hold it against blade to check camber. If it doesn't fit, use knife and sandpaper to shape blade to fit.

Blades are reduced to final thinness with sandpaper, but don't destroy camber. Keep checking with templates. Use fine sandpaper to give final finish. Tips are rounded with knife and sandpaper.

Balsa props may be balanced on a piece of wire as at left. If one blade swings to bottom, sand it slightly and try again. Do this until prop will stay in any position without dropping one blade.



To Make Candles Fit Their Holders

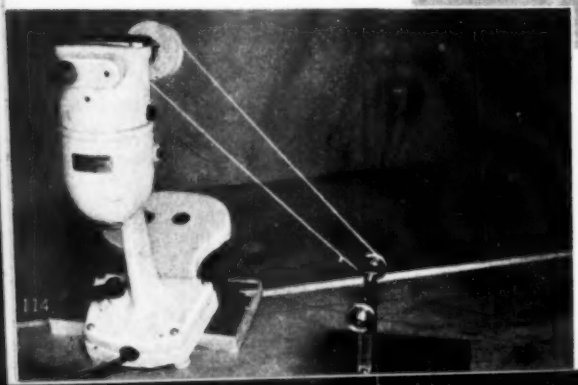
WHEN candles are too large for their holders, there's an easier and neater method of making them fit than whittling down their bases with a knife. Take a cup or bowl of very hot water and dip the bases of the candles in it a number of times until they are of small enough size.

Hot Lemons

THERE are various methods designed to get just a little more juice from lemons, and this one will be found to work as well, if not better, than the others. Place the lemon in the center of the gas stove burner with heat off and warm it before squeezing.

When Rugs Slip

DON'T risk a broken arm or worse because of small rugs which won't stay in place on waxed floors. They'll stay put if you remove the thin, cork disks from the inside of ordinary bottle caps with a sharp knife and glue them under the rugs.



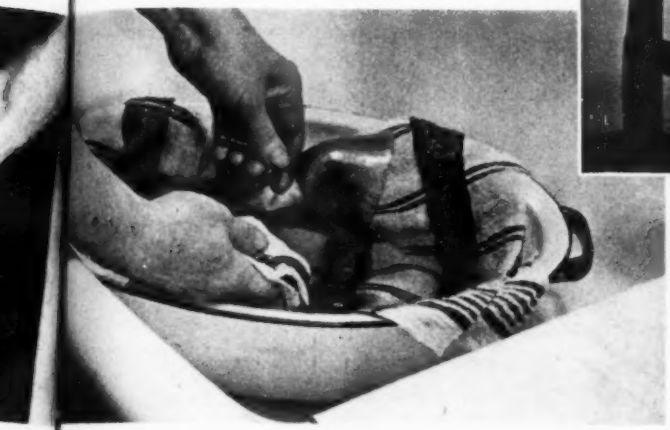
New Use For Mixer

THE motor of an electric mixer can be adapted to Junior's mechanical toys by cutting out a small wooden pulley and providing it with a slotted shaft to fit the mixer shaft. Use string as belt.

Mechanix Illustrated

Chair Backs Help When Winding Wool

A PROBLEM to knitters always will be that of winding a skein of wool into a ball; the usual method is to have someone else hold the wool while you wind. The job can be done by one person if the skein is placed over the backs of two chairs. Adjust distance to hold the skein taut.



Washing China

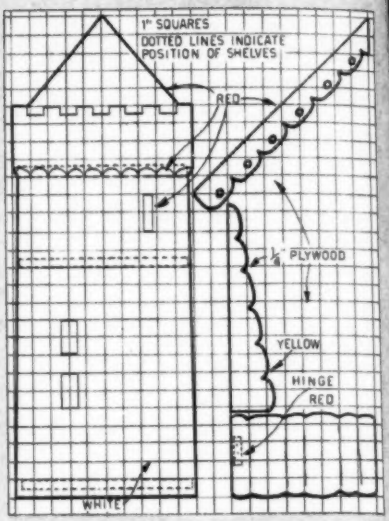
HOUSEWIVES need not hold their breaths while washing fragile, expensive pieces of china or delicate glasses when a clean hand towel is placed in the bottom of the dishpan. The towel will act as a buffer and will lessen the danger of their being chipped.

For Shakers

THE tiny corks used in salt and pepper shakers from dinner sets have a tendency to work their way up inside the shakers after a while. Strips of Scotch tape placed over the openings will hold the contents as securely as corks and can be removed quite easily.

Toaster As Presser

YOUR iron isn't working? Then use that sandwich toaster to press small items such as handkerchiefs, etc.; it works surprisingly well. Cover bottom half with piece of plywood to provide flat surface.

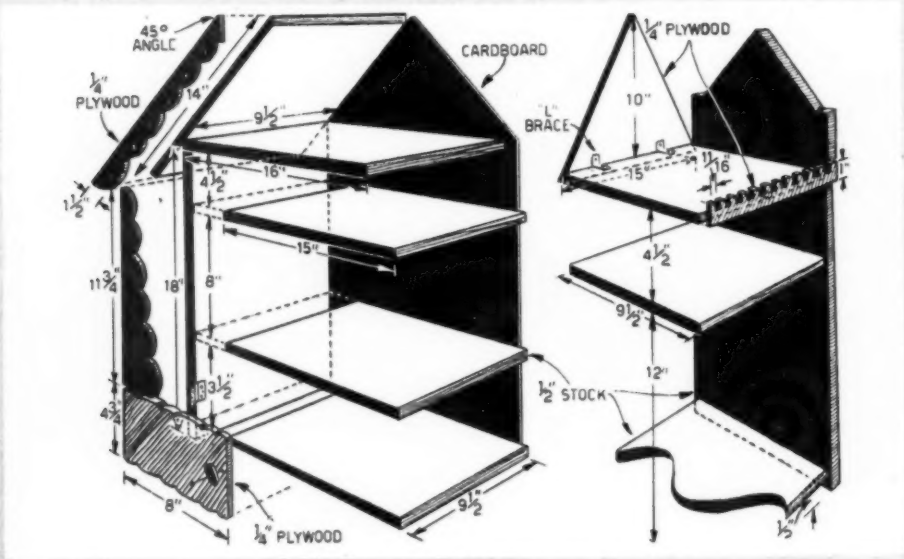


This is the doll-house bookcase. The squared drawing above includes the side of the castle.

CHILDREN'S FURNITURE

DESIGNED FOR FUN

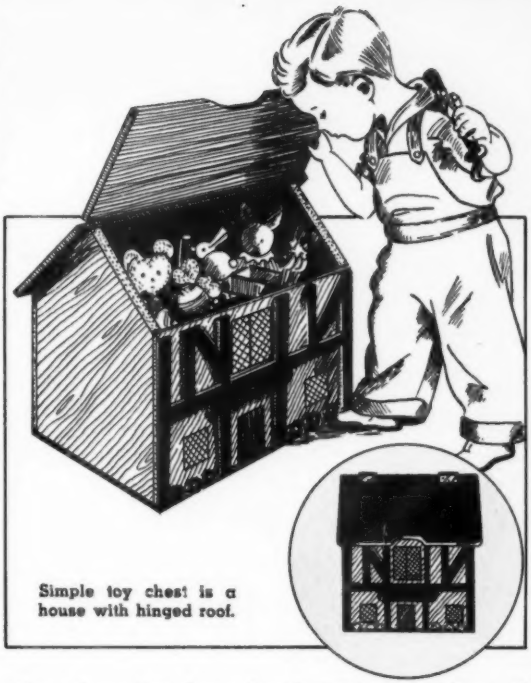
The details of the doll house and castle are shown below. Cut all the main pieces from ½" stock.



SHELVES which suggest a house or castle are just the thing for the children's room where they can be used to hold books and toy treasures. Having play value as well as keeping the room tidy, parents will find that they will solve a real problem. The small chest described herein also will serve to keep Junior's room in order.

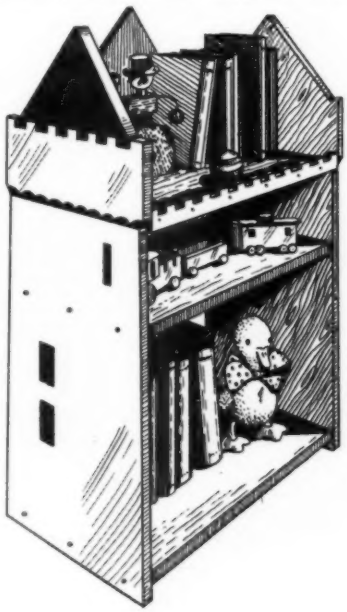
To make the doll-house bookcase, cut three shelves 9½"x15" and one shelf for the top 9½"x14". All are cut from ½" stock. Put in the shelves with wood screws, nail on the roof and enclose the back with a section of cardboard. Next saw out two scalloped ¼"-plywood sections for the roof and sides and nail them in place. Cut from plywood, also, the two doors 4¾"x8" and attach them with one hinge on each side. A section of ½" stock fastened to one door with a long screw will act as a latch.

For the castle, saw out the two side sections as indicated in the squared drawing, and the three shelves 9½"x15" from ½" stock. Attach the shelves with screws. Cut the roof section, a triangular piece 15" at the base and 10" high, from ¼" plywood and nail it to the back of the top shelf. Secure two "L" braces in front for added strength. Cut the parapet from ¼" plywood and nail it to the front of the shelf as shown. Finish in bright colored enamels; colors are suggested in the squared drawing.

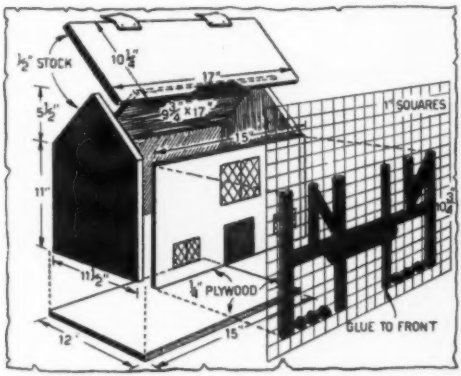


Simple toy chest is a house with hinged roof.

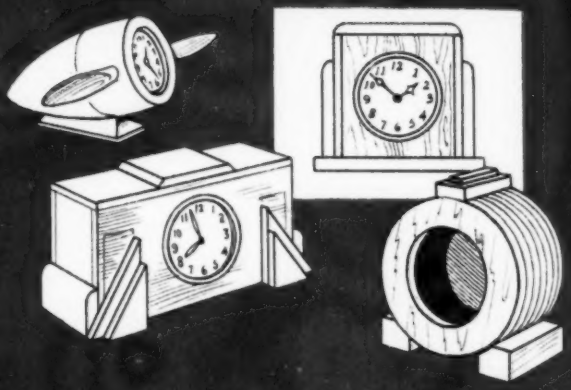
Finish castle in colors suggested in drawing.

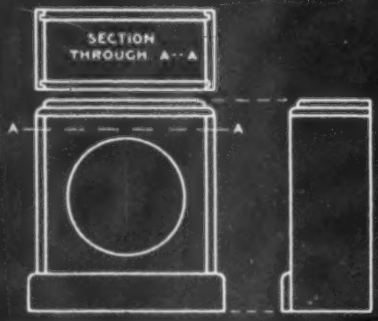


The toy chest is constructed as a box. Cut the ends and the two roof sections from ½" stock and the front, back, and bottom from ¼" plywood. Nail together all but the front half of the roof which is the lid; attach this section with two leather hinges. Next cut the plywood facing and nail it to the front of the house.—*R. L. Fairall.*



Box-like chest has plywood facing glued to the front.

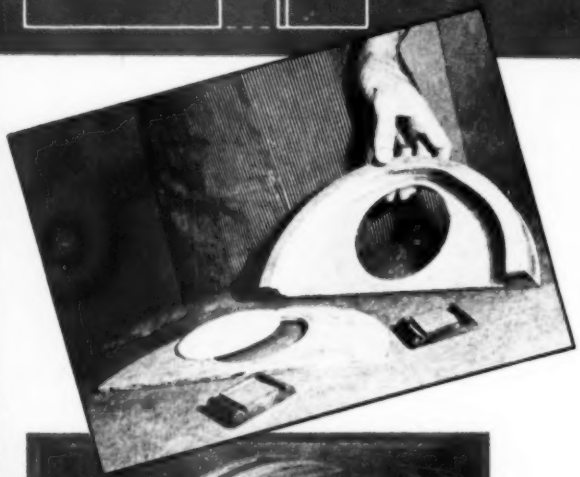


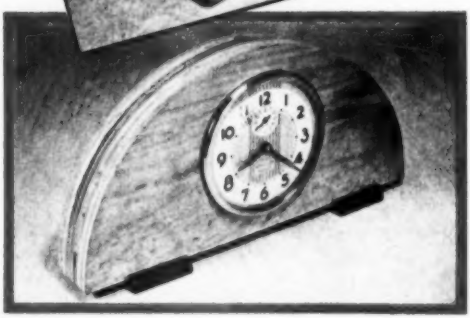


Clock Cases

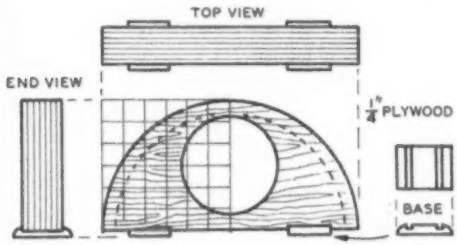
YOU CAN MAKE

by Charles and Bertram Brownold

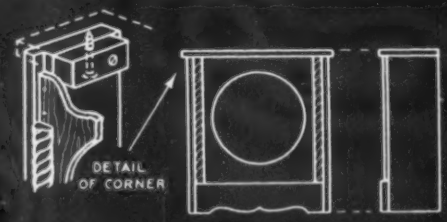


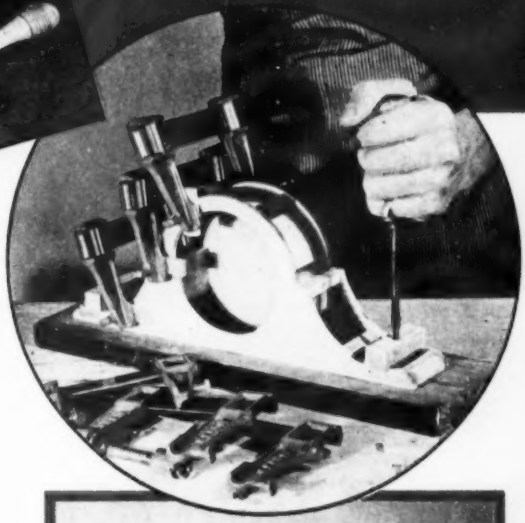


VERY interesting projects can be developed in designing and building ornamental cases for clocks of various kinds, including the electric as well as the small spring-driven type. Most households have a number of such clocks in various parts of the home; they come in plain and fancy cases of metal or plastic. The case is usually just a shell similar to the one shown in the photo at the top of page 120. This one is an electric kitchen clock

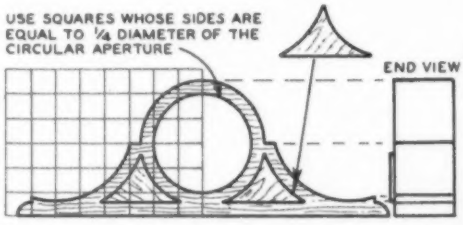


This case is made of plywood arches glued together.

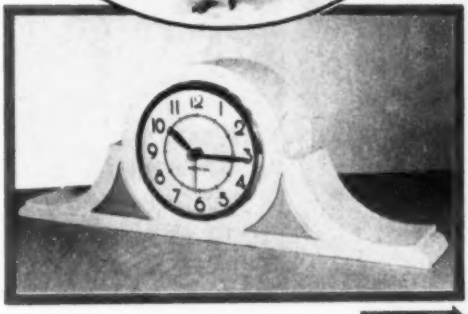




made to hang on the wall, but a wooden case has been made for it (shown partly finished in the same photo) which transforms it into a mantel clock of a type which now sells for ten or twelve times its original cost. The same transformation can be achieved for any small clock, and even that old, battered alarm clock from the bedroom can be similarly "glamorized" without much trouble.



Construction of this model is explained in the text.



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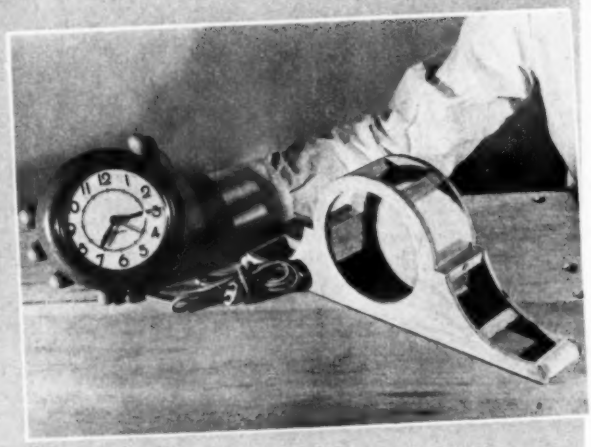


Photo above shows the kitchen clock used and the plywood frame. Works were removed from original case.

Case was covered with pieces of fiber board. Pieces from cut panels and clamp were used as gluing jig.

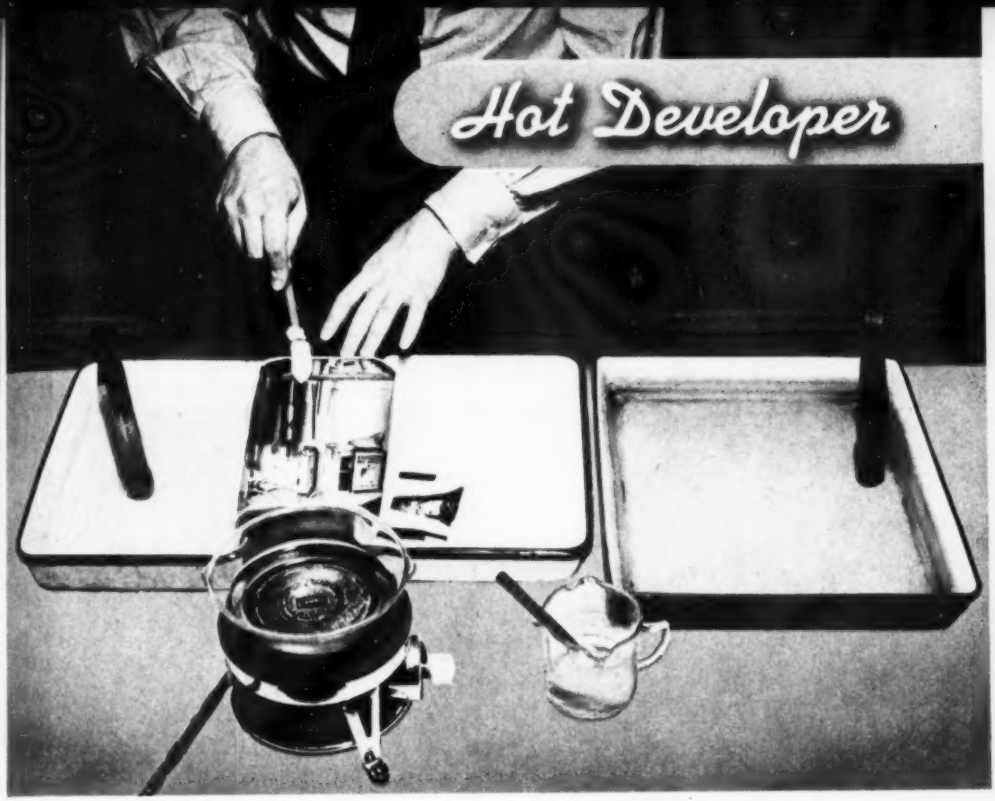
The cases can be made of scrap wood, plywood, molding and other left-over material, and, while their cost is nil, their appearance when completed (if care has been exercised in the construction and finish) will be professional and distinctly ornamental.

The cases shown were all made in the same general way: simply a wooden case, box or housing with a circular aperture in the front panel to accommodate the face of the clock. You can remove the metal or plastic case in which the clock came and house only the movement, or leave the case on and house the whole thing. If you adopt the latter course, the clock must be blocked in position inside the case you make, but if you house the movement only, you can screw it to your wooden case through the same holes that accommodated the screws which held it in the original case.

If the clock is an electric clock, the starting lever and the knurled knob that sets the hands must be easily accessible after the clock is in its new home. This is not difficult because the cases can be made bottomless and even backless if they are intended to stand on mantels with their backs to the wall. If the clock is not an electric clock, then the winding key and the setting knob must be accessible.

The case shown in the first photo was made of ½" oak, which was sanded, stained and waxed. Construction details are shown below the photo.

The front and back panels of the case design at the bottom of page 118 are semicircles of ¼" plywood, the radii of which are about 2" more than the diameter of the face of the clock used. A number of arches were jigsawed from ¼" plywood and glued one on top of the other to the front panel. As many arches were used as were necessary to give the case sufficient depth. The gluing was done under pressure, and, when dry, the exterior curve was sanded smooth on a sanding disk. The aperture in the back panel has a lid pivoting on a screw. [*Continued on page* 136]



Hot Developer

by Roy Lester

MODERN negative materials have lots of latitude. They record detail in the densest highlights as well as the deepest shadows, often on a single film. How unfortunate it is that printing paper can't have this latitude also, and reproduce the full scale of tones recorded in a negative! Although our paper doesn't have this quality, still we can help our prints along by giving them a little chemical encouragement where needed.

For this purpose, keep on hand a couple of side dishes of developer, one containing a concentrated solution and the other a hot solution. The former should be straight D-72, the latter D-72 diluted 2:1. When development of your print is almost complete, transfer it to a flat sheet of glass and with a swab dipped in one of the side solutions bring out or burn up the obstinate areas. Then fix as usual. Use the hot stuff sparingly; it's dynamite.

Make swabs by tying cotton to pencil ends.

PHOTO CONTEST

FIRST PRIZE ($10.00): Swooner, by Jack Garber of Brooklyn, New York. SECOND PRIZE ($5.00): Young Ship Builder, by Tony Rizzo of Chicago, Illinois; taken with a Speed Graphic on panchromatic film. THIRD PRIZE ($4.00): Bee, by Meyer Feinstein of New York City; taken with a Recomar 18 on Isopan film. FOURTH PRIZE ($3.00): Mystery Story, by Dan Rumpf of Topeka, Kansas; taken with a 1A Graflex on Verichrome film.

1st PRIZE

2nd PRIZE

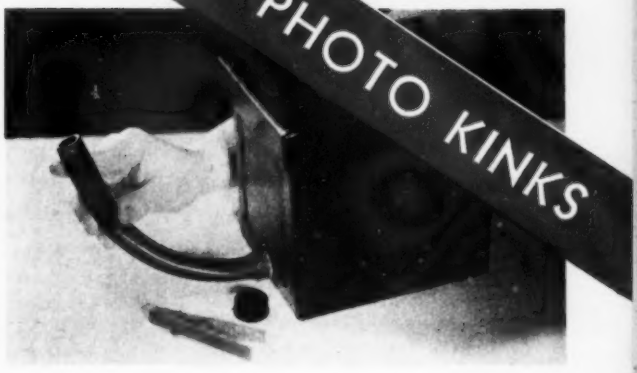
3rd PRIZE

4th PRIZE

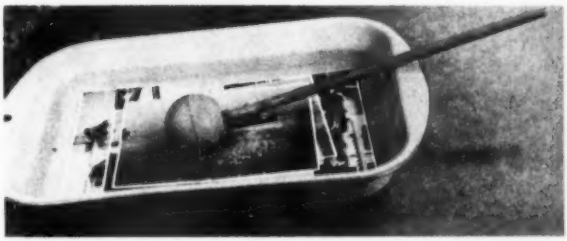
Submit contest prints unmounted—no larger than 8x10 inches. With each print list camera, film, lens opening and shutter speed, illumination and developer. Write your NAME and ADDRESS on the back of each print and wrap securely with cardboard or corrugated stiffeners. ENCLOSE POSTAGE for the return of unused prints. Published prints cannot be returned. Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, New York.

PHOTO KINKS

BOTTLE LABELS: Labels attached to solution bottles by the ordinary method usually don't last very long; the solution itself, running down the bottle when poured, and wet hands soon loosen and remove them. An easily applied protective coating for labels can be made of clear cellophane scotch tape applied in strips like roof shingles.—M. Cotton.

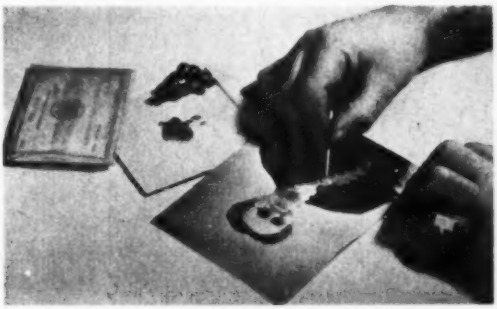


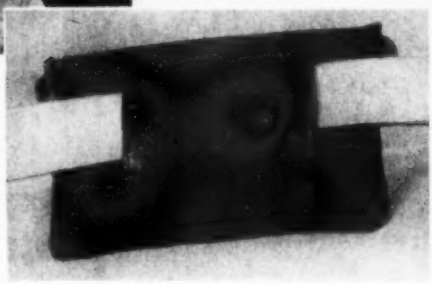
LEAKING FILM TANKS: When draining a tank with a screw-cap outlet at the bottom, the solution sometimes leaks out before the cap is entirely unscrewed. A small hose is the remedy.—Louis Hochman.



TO KEEP PRINTS SUBMERGED: The top print in your hypo bath can be kept submerged between agitations if a sponge-rubber ball with a dowel inserted is placed on top of the stack.—William Swallow.

ACCESSORY POUCH: The accessory bag worn on the belt of the photographer in the above illustration was converted from an old tobacco pouch. An extra piece of leather was sewn on the back to accommodate the belt (right). It contains filters, lens shade and roll film.—Victor Ciomei.





TINTING PHOTOS: When tinting a photograph with oil colors, metal articles in the pic may be given a finish of the proper color and luster, too. To make this tinting substance, place a little oil color medium on a glass plate and mix in a small portion of silver, gold or bronze powder. Apply with a toothpick.—K. Murray.

Try Some Strobo Pics

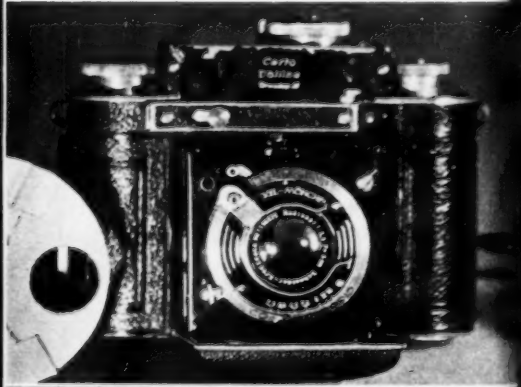
This simple strobo shutter can be made for any camera. It really stops action!

by Louis Hochman

WITH the advent of stroboscopic lighting, photographers have been able to "shoot" rapidly moving objects and get a series of stills of the action on one negative by making lightning-like successive exposures. The cost of the necessary equipment is high, however, and not within reach of the amateur's pocketbook, but this simple, home-made substitute will bridge the gap and give equally effective results.

It is a stroboscopic shutter, designed to work over your camera lens and to make a succession of rapid exposures while the light intensity remains constant. Its effect is the same as though the light were flashing intermittently.

It consists of nothing more than a disk of shutter openings mounted on a pivot in front of the camera lens and made to revolve rapidly by air pressure. The camera shutter is, of course, kept open during the stroboscopic exposures. The stroboscopic shutter disk can be made either of heavy cardboard or sheet metal and its diameter should be sufficient to accommodate several shutter openings and



At left is a strobo pic of a cat falling. Shutter support is clipped to the camera lens as above.

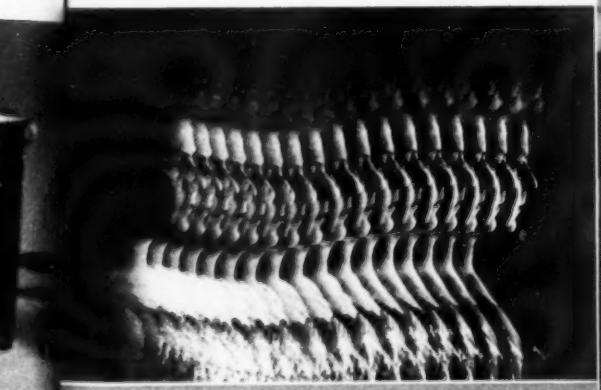
yet fit conveniently on the camera for which it is designed. For the openings, cut holes the diameter of the camera lens around this shutter disk at such intervals that the spaces between each will be slightly more than the diameter of the camera lens.

To attach this disk to the camera, make a clip of spring brass to snap tightly over the camera lens holder, and to this solder a small metal arm provided with a pivot hole. It should revolve freely on this arm, and when mounted on the camera, the shutter openings should pass directly in front of the lens. If necessary, a small glass bead can be slipped on the pivot behind the shutter disk to lessen the friction. To prevent reflections, paint all inside and outside surfaces of the disk a dull black.

An easy way to spin the disk is to use air pressure, and for this, wind vanes of folded gummed paper should be added to it between the shutter openings as shown. The "wind" is provided by a length of narrow rubber tubing with a rubber bulb attached to its end. The other end of the tubing can be attached to the front of the camera by means of a rubber band or a suitable clip, and aimed at the vanes. A small bakelite nozzle obtainable at surgical supply houses, can be added to this end of the tube, as shown.

To use this stroboscopic outfit, fasten the camera to a tripod, set its shutter on "bulb" and attach a cable release. All pictures should be taken against a black background. Set up as many lights as you can to cover flatly the path in which the moving object will travel. Then start pumping on the rubber bulb until the [*Continued on page* 134]

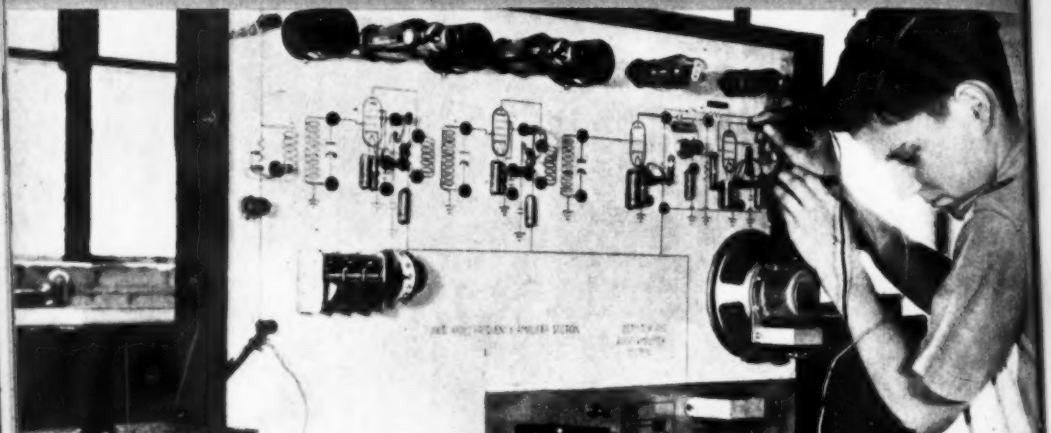
This photo shows strobo shutter, support and air nozzle. Shutter vanes are gummed paper.



In this pic the model is walking before the camera. Air from hand bulb rotates strobo shutter (right).

DYNAMIC DEMONSTRATOR

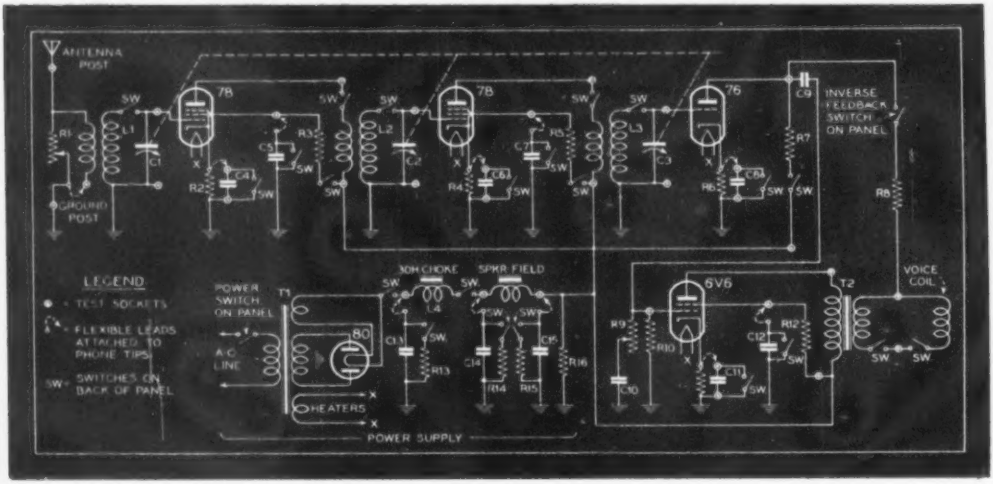
. . . . by Walter B. Ford



The student uses the demonstrator to practice the recognition and correction of radio troubles.

THE use of a dynamic demonstrator is generally conceded to be one of the best methods of making the layman familiar with radio parts and circuits. With the parts of the circuits arranged on the panel in their respective positions, and the symbols representing each part close by, the beginner learns the function of each element in but a fraction of the time it would take him by the otherwise devious method of delving into the maze of wiring in a modern radio set.

This easily built dynamic demonstrator has several features not previously presented in the commercial demonstrators which have

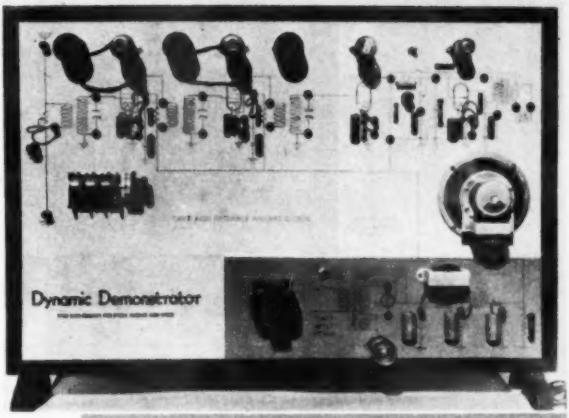


appeared on the market. Chief among these is simple switching arrangement on the back of the panel whereby any trouble that is apt to occur in a radio set may be quickly simulated. With the circuit switches so placed, the learner does not have access to the back of the panel and must locate the trouble by proper testing procedure. The demonstrator may be built with salvaged radio parts, or where a complete set is available it may be transferred to the panel with little trouble.

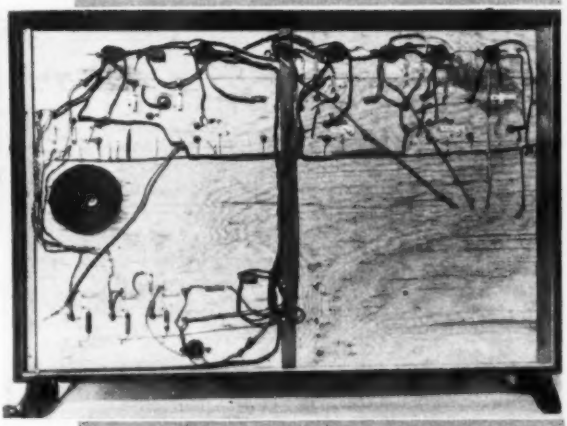
Divide the panel into sections for each part of the circuit, as shown at Fig. 2. Either of two methods may be used for coloring the sections of the panel and drawing the circuits on each section. One method is to glue colored sections of cardboard to the plywood panel and draw the circuit on the cardboard with a soft pencil or drawing ink.

The other method is to paint the colored sections of the circuit directly on the plywood, and then draw the circuit on each painted section with drawing ink. Whichever method is used, the completed panel should be given a coat of varnish or shellac after the circuits are drawn.

Mount each part on the face of the panel, close to the symbol representing it in the circuit drawing. The resistors and fixed condensers may be securely fastened to the panel by drilling small holes through the panel for the terminal leads, passing the leads through the holes and bending them at right angles at the back of the panel. Pin jacks are provided so that voltage or resistance tests may be made at any point in the circuit. Pin plugs and flexible leads are also provided so that individual resistors and condensers may be isolated from the rest of the circuit for testing purposes. The pin jacks and plugs may be purchased from a radio supply house, or phone cord tips in conjunction with jacks made according to the drawing, Fig. 3, may be used. These consist of 10-24 R. H. brass, machine screws, faced, drilled, and slotted. The factory-made jacks have an insulated head, so if the builder makes his own jacks, a thin paper washer should be placed under the head of each one as it is installed, to prevent it from making contact with the pencil or ink lines on the circuit drawing. The heads of the jacks should be painted to provide a commercial appearance, and to facilitate testing; high voltage circuits, red, low voltage circuits, black.



Here is front panel as student sees it.

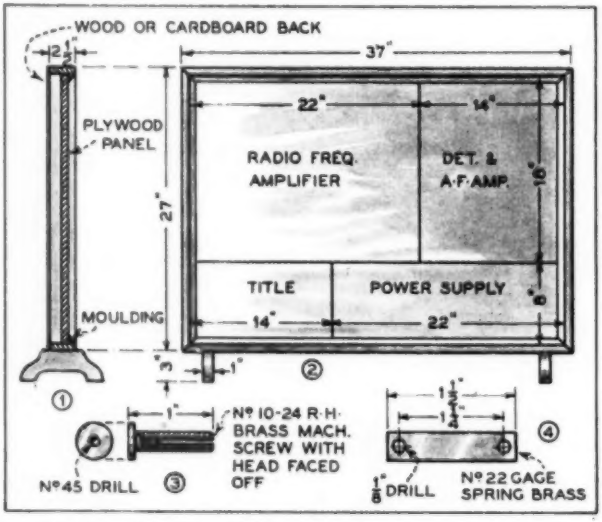


Switches "throw out" to simulate trouble.

Before the panel is wired it should be placed in its frame and mounted on legs, as shown at Figs. 1 and 2. Mitered joints at the corners will add to the appearance of the completed panel. In wiring the circuit at the back of the panel, all grid and plate leads up to the detector tube should be shielded with flexible shielding and the shielding grounded. This will assure stable operation with a complete absence of unwanted noises.

Single-pole switches are provided at the back of the panel, so that short-circuits or open circuits may be produced to simulate troubles actually occurring in a radio set. These switches consist of strips of spring brass, drilled as shown at Fig. 4. The hole in the end of the switch arm fits over a wood screw, which is used as the other terminal of the switch, and provides a positive contact at all times. It will be noted that no switch produces trouble that is apt to damage any part of the set. Instead of placing a direct short-circuit across the filter condensers with possible damage to the rectifier tube, resistors of such values as to indicate a defective condenser when the condenser is tested are placed in parallel with each filter condenser. Labels indicating the normal operating position of the switches are placed adjacent to each switch, so that to produce a defective circuit it is necessary only to place the switch in an opposite open or closed position.

A cardboard cover is provided for the back, so that the learner will have to determine the cause of existing trouble by testing at the front of the panel. A circular opening should be provided in the cardboard back directly opposite the speaker opening in the front panel.

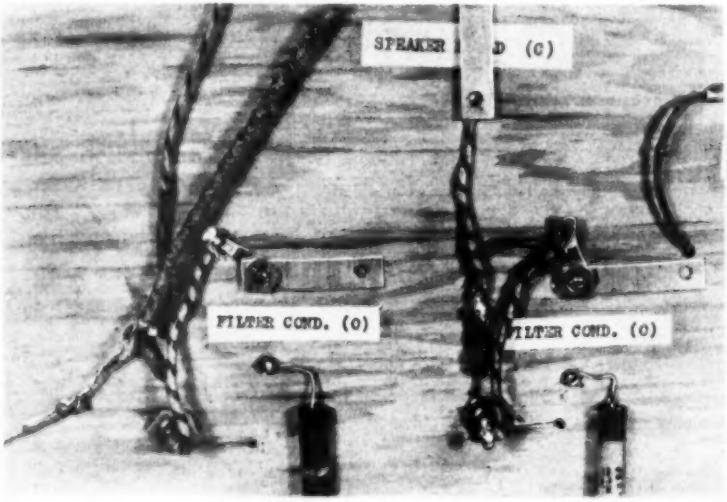


Drawing shows the general layout. Numbers are referred to in text.

LIST OF PARTS

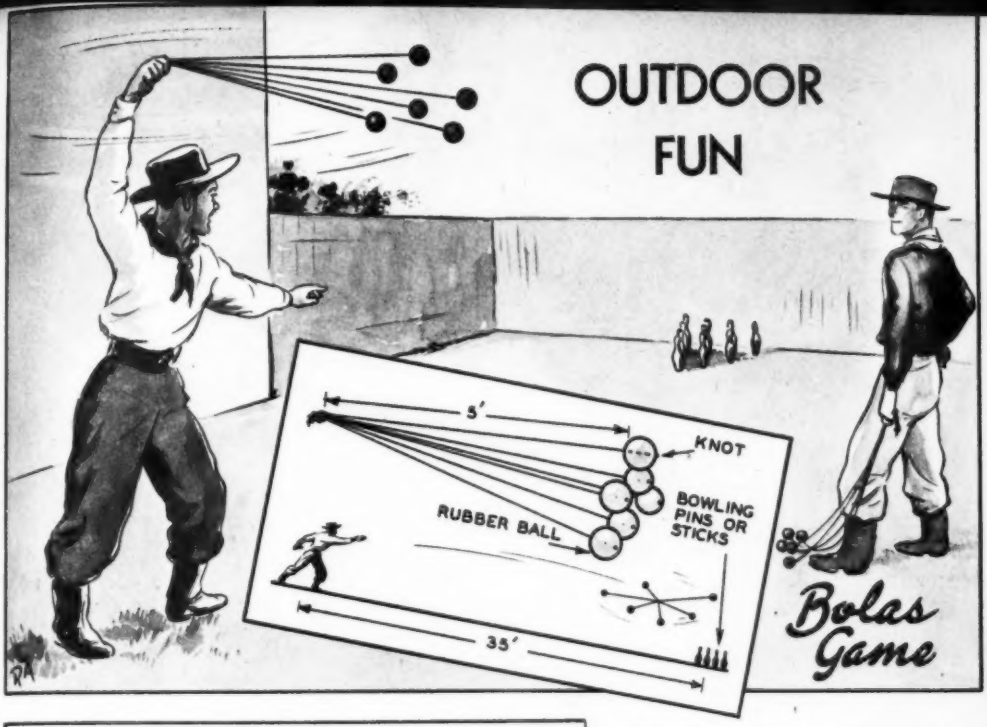
R1, R9, 500,000 ohm potentiometer
R3, 75,000 ohm resistor, 1 watt
R2, R4, 500 ohm resistor, 1 watt
R5, R7, 100,000 ohm resistor, 1 watt
R6, 150,000 ohm resistor, 1 watt
R8, 50,000 ohm resistor, 1 watt
R10, 500,000 ohm resistor, 1 watt
R11, 250 ohm resistor, 1 watt
R12, 5,000 ohm resistor, 1 watt
R13, R14, R15, 500,000 ohm resistor, 1 watt
R16, 15,000 ohm resistor, 10 watt
C1, C2, C3, 3-gang variable condenser, .000365 Mfd.
C4, C5, C6, C7, C10, C12, Fixed condenser, .005 Mfd., 450 volt
C8, Fixed condenser, .05 Mfd., 450 volt
C9, Fixed condenser, .01 Mfd., 450 volt
C11, Electrolytic condenser, 25 Mfd., 25 volt

[*Continued on page* 134]



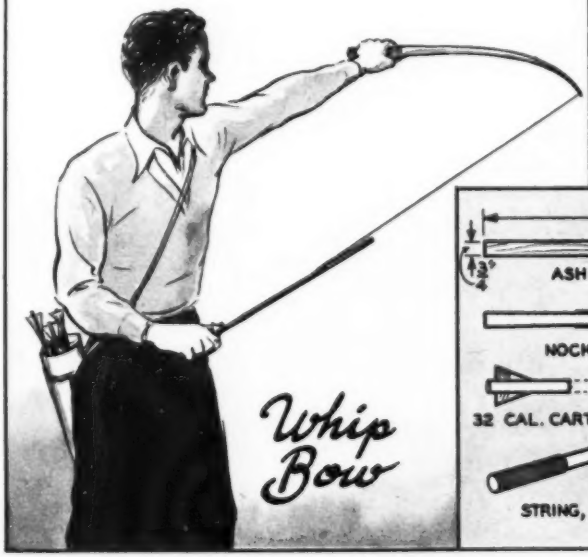
These are the circuit switches on back of panel. Make them of spring brass strips.

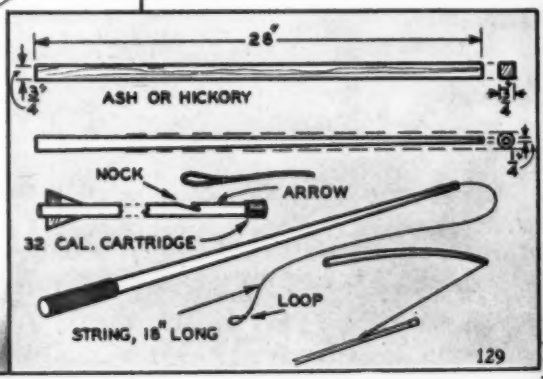
OUTDOOR FUN



THIS half-bow device is something different in the line of archery equipment. Its name is derived from the fact that its arrow is propelled by a whipping motion of the arm and bow. Arrows are made from dowels and may vary in length from 12" to 18". Bow string is twisted and waxed shoemaker's thread or strong twine. Wrap cord on handle.

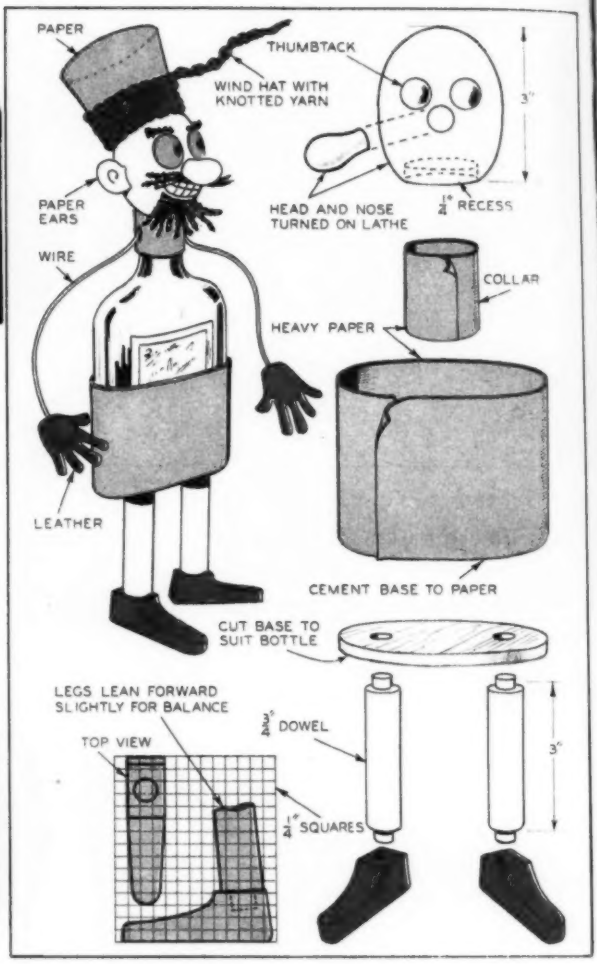
HERE is a play version of the weapon used by the South American Gauchos. Two types of targets may be used for this rubber-ball Bolas; either bowling pins or six small, colored sticks placed in the ground 3" apart. The object of the game is to see how many pins or sticks can be knocked down. To throw the Bolas, grasp it by the knot and whirl it rapidly over your head, releasing it toward the target. Your first throws may be wild but practice will make perfect.





FANCY DRESS
For Drinks

Here's one in a Russian Cossack motif.



by George Daniels

YOUR guests will get even more of a kick out of the refreshments you serve them if you dress up each bottle in a costume which fits the personality, shall we say, of the liquor it contains. The most difficult part of this project is getting the "stuff," but once you have solved this problem, the rest is easy. The drawing shows you how it's done with pints but can be adapted to fifths, too. The Russian costume is good for vodka, an Irish one for rye, Scotch for Scotch and a red devil for your favorite firewater.

Ordinary cotton material serves for the blouse of the doll shown, while jacket is velvet and plus-fours are satin. Plan dress to permit easy removal of top.

"PLENTY RUGGED", say our fighting men, to sum up the tough jobs . . . to patly describe any grim task from long, forced march to furious battle action.

Rugged too are the assignments that Evinrudes are capably handling in every part of the world—from busy home ports to beachheads on distant fighting fronts.

Powering lighters, ferries, tenders, work boats . . . many Evinrudes are rolling up operating records equal to several lifetimes of ordinary duty.

On assault craft, swift and powerful "fighting" Evinrudes have proved their stamina on many fronts. Evinrudes serve with England's famed Commandos. Great Evinrude "fours," specially developed for the purpose, drive many of the Army's speedy Storm Boats.

Motors for such service . . . motors of many types for our fighting forces . . . are the only kind we are building now. Some day new peacetime Evinrudes will follow down the production line. You can be sure they will be tops for "rugged" service . . . and that in every other characteristic, they will be sheer pleasure to own!

EVINRUDE MOTORS, *Milwaukee, Wisconsin*

KEEP BACKING THE ATTACK
BUY MORE WAR BONDS

EVINRUDE
OUTBOARD MOTORS

Mite Cycle

[*Continued from page 88*]

be exact as the bearing will slip on the shaft if it is turned undersize. The pulley adapter is turned and since it is used for an arbor in turning the large pulleys, it must be left long enough to chuck in the lathe and is cut off to size only after completion of the 6" pulleys. A retaining nut is used to lock the pulleys on the adapter during their machining, and this nut now is made and mated to the adapter. Two cast-iron blanks ¾" wide and 6" in diameter are used for the 6" pulleys, and these can be secured at the local foundry. They are chucked in the lathe, first one side and then on the other.

The pulley web, although thin (⅛"), is sufficiently strong. Upon completion of machining the web, a 1" hole is bored through the center and, with a boring bar, the diameter of the hole is enlarged to 1" .140 and threaded left hand 24 threads per 1". Using the adapter as a gauge, thread carefully until the adapter will screw into the pulley with effort, for it should be a tight fit, and after this is completed, remove the pulley from the lathe and turn the other pulley in a like manner. Next drill the pulleys for the spanner wrench which must be constructed. The adapter is returned to the chuck and a pulley is screwed on with the aid of the spanner wrench, and the nut is screwed on to lock the pulley in place. A light cut is taken on the outer diameter of the pulley to true it up. A cut-off tool is placed in the tool rest and a cut is made in the middle of the pulley to a depth of $\frac{5}{16}$". The compound rest is swung 19° to one side and the angle is cut into the pulley, then 19° the opposite direction and the angle cut from that side. Except for a little trimming in the bottom of the V, the pulley is now complete. This process is repeated on the other pulley.

The extension on the adapter now can be cut off and the adapter drilled and tapped for the set screws. A smaller drive pulley of 2⅛" is turned and the V is cut as on the large pulleys; a 9/16" hole is drilled through and the end is tapped for a $\frac{5}{16}$" screw as noted. Bearing housings are made simply with 1½"x.065 wall tubing brazed to a ¼"x1"x3" cold rolled steel strap; the ⅜" tubing is then brazed on the 1½" tubing and the unit is split with a hack saw. Two of these are required. The countershaft bearing supports are made of 18-gauge steel and are drilled to mate with the bearing housings. Bolt the bearing housings to the supports and assemble the countershaft, putting the two New Departure 5202 bearings in place, and then install the adapter with one 6" pulley screwed to it. The bearing housings are slipped over the bearings and clamped into position. The whole assembly is put into place on the frame uprights and the countershaft bearing supports are spotted in position on the uprights. This makes sure that the countershaft will not bind when installed on the frame supports. Bearing housings should be loosened and the countershaft removed from the frame when the supports are welded.

Two standard bicycle wheels 20x.125 are used; these are 24-spoke front wheels complete with bearings and axles. One is used without change for the front wheel of the Mite Cycle. The hub is removed from the wheel to be used on the rear and the spoke holes are redrilled for ⅛" spokes. Chuck the hub in the lathe and turn the ends to 1" .180 then thread left hand 24 threads per 1". Use the large pulley as a gauge and thread until the pulley can be screwed on with effort. When both ends are completed, remove the hub from the lathe and re-spoke the rear wheel with ⅛" motorcycle spokes. These can be procured from an old motorcycle wheel and must be cut to 6⅜" lengths and then re-threaded to fit the spoke caps. With the rear wheel re-spoked, screw a pulley permanently in place with the spanner wrench. Then machine the brake drum and screw permanently in place on the opposite side of the wheel. The brake band is 18-gauge steel lined with regular lining cut to the size required. The band is a ¾ type and is self-energizing as it has a tendency to wrap itself around the drum when the brake is applied.

The brake plate is made of ⅛" cold-rolled steel and joggled ¼"; the top slotted hole allows for adjustment of the rear belt. The band anchors on the lower bolt hole and actuates from a small bellcrank and rod anchored at the forward end. A standard bicycle handle-bar squeeze lever and cable is used to actuate the brake. The cover for the countershaft and engine pulleys is made of 22-gauge tin cut to streamline and has 2" flanges soldered to it. Now procure a set of standard 20x2 .125 fenders from the local bike shop and our Mite Cycle is ready to assemble.

Install the front wheel and fender on the front fork, install the bearings in the fork neck and attach to the frame. Install the handle-bar gooseneck into the fork tube, line up and tighten. The engine is installed next and has a $2\frac{3}{16}$" pulley attached to the crankshaft. This is a die-cast pulley and may be purchased locally for about fifty cents. The countershaft is installed; the rear belt must be in position around the shaft before tightening the clamps, this rear belt being ½"x48". The large pulley is installed on the countershaft and a ½"x35½" belt is used between the engine and countershaft. Adjustments are made and the engine tightened securely.

The gas tank has been left to individual taste, but if an injection carburetor is used, a standard one-gallon can, located inside the frame underneath the seat, will be satisfactory. The can screw top is carefully cut out and a piece soldered over the hole; this screw-top portion then is soldered on the side and at the rear of the can. Small lugs also are soldered to the can, and it is installed with sheet-metal screws running through the

[*Continued on page 134*]

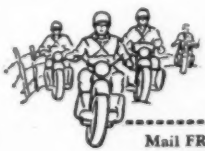
INDIAN
TRAIL BLAZERS

Which Way Adventure

Take the right fork... or the left... there's fun, fellowship and the greatest sport in the world just waiting for you when you own an Indian, America's most famous motorcycle. With an Indian, you'll enjoy a thrilling new freedom... away from plodding traffic lanes. You'll be able to explore those out of the way places no car can ever get to. On smooth highways or country roads... you'll find that your Indian ride will be incredibly smooth. You'll experience a feeling of safety and confidence you never believed possible. Make your plans now so that when this war is won, you can enjoy motorcycling at its finest, astride an Indian.

INDIANS ON THE WARPATH

Right now, all new Indian Motorcycles go straight to war, and what a fighting record they're turning in! But new, improved, postwar Indians are already being blueprinted. *They're the motorcycles to wait for!*



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Address.....

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Indian
MOTORCYCLES

Hawker Typhoon

[*Continued from page* 111]

removed by cutting off the back and screwing a large hook and eye in the wood. Insert a spatula as before and pull on the screw.

The wings are part plastic and part balsa or pine. The center sections are built up of ⅛" wooden formers and stringers as shown, with scrap sheet between the stringers. In one, the landing gear (with its shock absorber) is installed and then the section is covered with 1/32" sheet balsa or two layers of bamboo paper. The other side is left open until after the wing is attached to the plane. Cutouts will be necessary in the center rib and covering to accommodate the gas tank. The wing tips are constructed separately of gauze and glue wrapped on a form as was the fuselage shell. Stringers are inserted where indicated. When the wings are ready, slip one end through the cutouts in the fuselage, adjust to the proper position and glue. Then mount the other landing gear and cover the section.

For the next step, the engine is mounted in inverted position and the gas tank and bell crank and wires for the U-control are installed. Glue a lip near each edge of the base piece on top of the lower shell so that when the top shell is attached, the fit will be secure.

Before installing the formers in the top shell, make the cutout for the greenhouse. The canopy can be made by heating a scrap piece of plexiglass and bending it over a wooden form, tacking it in place below the trim line. When it has cooled, remove it and cut the bottom to fit. Put in the dummy pilot and his head rest, fix the frame for the greenhouse and glue on the canopy. Don't forget the radio mast! The top shell is fastened to the lower shell by means of a long screw (see diagram).

The fin, rudder, stabilizers and elevators are made of thin balsa or pine sanded to the proper contour. Hinges may be made of adhesive tape or thin aluminum. Wires from the elevators run through the fuselage to the U-control bell crank.

An 8", 10" or 12" prop will pull your plane along at a fast clip. Props may be bought at your model store, but a better idea is to turn out one yourself. You'll find out how on page 112.

Mite Cycle

[*Continued from page* 132]

lugs into the frame members. The rear wheel is installed next, and here it will be found necessary to spread the frame slightly to clear the brake drum and pulley. Place the brake plate on the side shown and secure the rear wheel after adjusting the belt. The rear-wheel hanger is drilled and tapped 10-32 and bolted through the slotted hole in the brake plate. The rear fender is bent out on the forward end and attached to the tank with a sheet-metal screw through a small lug soldered to the tank.

Try Some Strobo Pics

[*Continued from page* 125]

shutter disk is spinning rapidly, and as the subject begins to move across the field of view, open the camera shutter by means of the cable release, letting it close only after the action before the lens has been completed. The resulting picture will show the moving object reproduced many times on the film, each image being in an advanced stage of the action.

Almost any action that moves in a small space is suitable for stroboscopic photography. By this means you can study movements too fast to follow with the naked eye. Knife tossing, ball throwing, calisthenics, acrobatics, etc., all produce interesting and revealing pictures.

The correct diaphragm opening to use with the stroboscopic shutter is best determined by making several tests at various openings, and once you've found the right opening, try to use the same amount of lighting each time.

Rapidly moving objects, such as the flying knife will move fast enough to reproduce as separate images on the film but objects that move slowly will have overlapping images which may be hard to analyze. To correct this you can cover up some of the shutter openings in the disk with black tape. This will result in fewer images spaced further apart.

Dynamic Demonstrator

[*Continued from page* 128]

C13, C14, C15, Electrolytic condenser, 8 Mfd., 450 volt
L1, Antenna coil, shielded
L2, L3, R. F. coil, shielded
L4, Choke coil, 30 henry
T1, Power transformer
T2, Output transformer
2, 6 prong wafer sockets
1, 5 prong wafer socket
1, 4 prong wafer socket
1 Octal wafer socket
2, 78 tubes
1, 76 tube
1, 6V6 tube
1, 80 tube
3 Tube shields
1 Dynamic speaker (Output transformer, T1, may be included with speaker)
Note: If a P. M. type speaker is used, an additional choke coil should be substituted for the speaker field coil.
32 Pin jacks (see text)
32 Phone cord tips
2 Toggle switches
1 Piece plywood, ⅜"x26"x36"
2 Pieces wood, ½"x2½"x27"
2 Pieces wood, ½"x2½"x37"
2 Pieces wood molding, quarter-round, ½"x½"x26"
2 Pieces wood molding, quarter-round, ½"x½"x36"
2 Pieces wood, 1"x3"x8"
1 Piece heavy cardboard, 27"x37"
22 Pieces spring brass, No. 22 Ga., $\frac{5}{16}$"x1½"

Airplane wings covered with glass cloth have proved practical in test flight.

TOMORROW...back home

MOVIES BETTER THAN EVER—

WITH FINER CAMERAS, FINER PROJECTORS

Lucky is the soldier camera fan who can snatch a spare moment of refuge from war with his beloved hobby—out where scenes are exciting and subjects exotic. But when he comes home Universal can promise him still other photographic thrills. For today Universal is employing new skills, pioneering new methods in the unceasing production of fine precision instruments for our armed forces. And tomorrow, after Victory, Universal will translate these same high achievements in optical instruments into a whole series of truly great cameras and other photographic equipment. Expect your next new camera to be a Universal!

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There's only one way to say it

Pacemaker Manufacturers of Mercury, Cinemaster, Corsair Cameras and Photographic Equipment

Planning Your '44 V-Garden

[*Continued from page* 99]

are delicious fresh or frozen. Sweet corn belongs in every large garden, but really doesn't pay in the small plot. However, if you must have your own corn, even at the expense of more productive vegetables, who am I to say you nay? There are some new dwarf varieties recommended for V-gardens that require less space, but their ears are small though sweet.

Cabbage is usually cheaper to buy than other crops but in these war years it pays. A greater delicacy, if you like it, is broccoli as it can be cut again and again and it will last until well after frost. However, it does not do as well in the southern states as in the North, it being a cool weather crop. The same thing applies to Brussels sprouts, which don't start "sprouting" until cool weather arrives. Cauliflower is difficult to grow well in the home garden.

Bush squashes such as Zuccini, Cocqzelle and Straightneck yield abundantly throughout the late summer and fall, but don't keep. The winter squashes take a lot of room and are harder to grow. Acorn and Butternut are fine for quality.

Having made your garden plan, order your seeds at once; also any tools, insecticides, and fertilizer that may be needed.

Meanwhile you should have found out whether your soil needs lime. A simple test with a bit of litmus paper will tell you whether your soil is acid enough to require liming. Put the lime on after spading rather than before and rake it in. If the ground breaks up nicely and seems dark and mellow you probably can get by with just a complete chemical or Victory Garden fertilizer, but if it seems hard or is sandy, probably humus is lacking. Well-rotted manure should be obtained if available, or peat moss or compost. There are other forms of organic plant food including bone meal, dried cow manure and sewage sludge that are useful. Apply the fertilizer at the time of planting in the row or alongside, rather than by broadcasting it. But if it is a chemical plant food, don't plant the seed in the drill with it but cover up the fertilizer with a bit of soil first.

Time spent preparing the soil for seeding is always well spent. You can't do a good job of seeding in a row that is full of clods, sticks and stones, or that is not smooth and level. Straight rows will make cultivating easier and look better. Lose no time in thinning out the young plants to the proper spacing. Some plants may be moved to other rows, but even if they are thrown away it is better than to have them grow up weak and spindly from overcrowding.

Don't try to plant all your garden at one time. Start with a few rows of the hardiest things such as radishes, lettuce, beets and carrots, but save the big-seeded crops such as corn and beans until the nights are warm and danger of frost is over. Consult your local garden chairman or state college bulletin for planting dates, or an experienced neighbor.

Clock Cases You Can Make

[*Continued from page* 120]

and the case rests on two feet (also shown in the photo) having grooves to accommodate the panels. This case was made of birch plywood, and the feet are walnut. The finish is three coats of clear shellac thinned out with alcohol and sanded well between coats.

The case at the top of page 119 was decorated by two pieces of half-round rope molding nailed in position. Any good-looking molding of suitable thickness would have done as well. The wood is white-wood and birch and the finish is two coats of orange shellac.

The fourth case was made of ¼" plywood. The front and back panels were nailed lightly together and jigsawed at the same time to the design shown. A circular aperture was cut out in the front panel. Struts were glued under pressure between the two panels and were prevented from creeping by small nails driven into their end grains and left protruding about $\frac{3}{16}$". The heads of these nails were cut off and the stumps filed to sharp points. These points sank into the plywood when the clamps were tightened. Bits of scrap wood kept the clamps from marking the work. During this gluing-up process the work was secured to a board by means of screws passing through hardwood blocks to keep the panels lined up correctly. When the glue was dry, the frame was covered with scrap fiber board; thin linoleum or any tough material pliable enough to take the curves could have been used.

This clock case was given a coat of flat white paint, followed by a coat of cream enamel. Two decorative pieces of ⅛" plywood shaped as indicated were painted a darker color and glued to the front panel. In making a case such as this, it is possible to adhere to the proportions shown simply by laying out squares whose sides equal ¼ of the diameter of the circular aperture you cut, regardless of what that diameter may be.

Drafting Outfit

[*Continued from page* 101]

side of moulding. A hole is drilled in them for screws; and these screws hold them to the supply box forming a pivot for raising and lowering drawing surface. The supporting braces are cut from ¼" material to shape and size shown as part (a) detail (D) figure 2. These are screwed to edge of supply box opposite hinges as illustrated in figures 4 and 5. These supports must fold freely on screws so they can be folded down when drawing board is to be closed. This position is illustrated in figure 4. Figure 5 shows them in upright position supporting drawing board. When in this position they will fit into notch (e) in the end mouldings to keep them from slipping.

AFTER THE WAR IS OVER...

AT fighting fronts or on production fronts — the desire for motorcycling thrills still lingers. And whether fellows wear campaign ribbons or Army-Navy "E" pins, their day dreams run about like this letter:

"In 1935 I bought my first '74' which I rode 5 years and turned over a good many miles of the best fun I ever had. After the war is over I've planned a trip that will take me over every state in the Union and will fulfill all my old dreams of a real outdoor trip!"

You bet! The days of long trips, race meets, hill-climbs and all other fun-packed motorcycling events will come again! Plan to be riding with the rest of the gang on a brand new Harley-Davidson — so Buy War Bonds NOW!

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Ten Commandments

[*Continued from page* 95]

If you are a male, DON'T wear a necktie when you work with or near moving machinery. Neither the tie nor your neck will look pretty if they get involved with a pulley or a saw blade. Ties also have a habit of getting into close and intimate contact with paint or glue. Not so pretty either. If you are a female, think of your hair. If you have curls, keep them away from moving things; bracelets and any other kind of jewelry for that matter, are dangerous.

VIII. If you are the orderly type, and, surely, if you are NOT the orderly type, it might be a good idea to keep records and worksheets of the more intricate jobs you are doing. Almost like a diary. They'll help you to remember things when similar jobs come up again. If you have a record of materials bought and used, money spent, time taken, procedure followed (including the mistakes you have made, and rectified, or short cuts you may have discovered), you'll soon have a very handy memorandum book which will help you and your friends in future jobs and problems.

IX. Don't buy more materials, hardware, tools than you know you need. DON'T HOARD nails, screws, lumber, anything.

X. No matter how brilliant you are, don't get too ambitious the first day. It's very fine if you decide to paint your whole house, inside and out. But remember, you can't paint the whole house in one day, or even a week, maybe. There are rainy days when the paint doesn't dry. There are other things that also need doing. Start with small projects first; then you'll be able to finish the job, sometimes even before you thought you might finish it. It's no good to have half-done jobs around. Don't underestimate your time.

You're good, but don't get too ambitious the first day.

Chemists count at least 14 major types of synthetic plastics now used in human apparel.

The School Shop

[*Continued from page* 105]

air decreases at the rate of 1°F. per 1,000 ft. We have seen that the altitude at which dew point and temperature come together will be our ceiling. Let us take a specific problem and find its solution. On a certain day when cumulus clouds are forming, a weather station reports a ground temperature of 75°F. and a dew point of 57°F. What is the ceiling? Since temperature and dew point approach each other at the rate of 4½°F. per 1,000 ft. (5½-1) as shown in the drawing, the difference between our temperature and dew point divided by 4½ will give us our ceiling. In this case it is 75-57 which is 18, divided by 4½ which is 4; our ceiling is 4,000 ft. A convenient formula to remember for these ceiling problems is: (T-D)2/9=Ceiling in thousands of feet.

Very interesting examples of condensation at high altitudes are the vapor trails left by our high-altitude planes, photo of which is shown on pages 102 and 103.

Fogs which present a severe hazard to the pilot are caused by atmospheric cooling, also. The two most important types are the *advection* fog and the *radiation* or *ground* fog. Advection fog occurs when warm, moist air blows over the surface of a colder area which cools it to the dew point. Radiation fog is formed on a clear, calm night when the earth loses its heat and cools the air near it to the dew point. Radiation fog usually is dispersed a few hours after sunrise; the heat of the sun or a fresh wind will disperse almost any fog.

A simple way to differentiate between these fog types is to remember that the advection fog requires a wind to move the moisture-laden air, while the radiation fog rarely occurs when the wind velocity is greater than 5 m.p.h.

Another flying hazard, which we must not overlook, is icing. Ice is likely to form on the wings, propeller and tail surfaces of a plane when *it is flying through some form of visible moisture* such as clouds, fog or rain, and the *temperature is between 26° F. and 34° F.* The two forms this ice may take are called *rime* and *glaze*. The former is a granular shell which can be broken off quite easily by the de-icing boots on the leading edges of the plane airfoil surfaces; the latter is a clear, solid type which cannot be disposed of as simply. A *slinger ring* on the propeller shaft distributes glycerine along the propeller to prevent ice from sticking to the blades.

Although ice does add weight and drag to the aircraft upon which it has formed, its most dangerous aspect lies in the effect it has upon each airfoil. It destroys the contour of the wing, control and propeller surfaces so that they no longer obtain the desired reaction from the air.

(Our next lesson in Meteorology in May MECHANIX ILLUSTRATED will be Lesson 15: *Winds and Weather.*)

Guardian Angels

The fireworks are all over. The "Sad Sack" is nearly home. A few minutes more, and she'll put her crew down safe on a friendly field.

She went out this morning full of fight, with her belly full of bombs . . . all four motors roaring defiance at every German in Italy.

She hammered the Nazi railyards at Terni, and left them a tangle of wreckage.

But she had to take a few on the chin to do it.

1st LT. DONALD J. JUSTER, of St. Albans, N. Y. . . . Air Medal with 9 Clusters, Bombardier of the Flying Fortress the "Sad Sack" . . . "I'll say an escort of fighter planes is a mighty sweet sight to see! Bombers and fighters, working together, make the A.A.F. an unbeatable team. And if you don't think so, take a look at Germany's big industrial centers from the air."

1st LT. JOHN D. JOYCE, of Griffith, Indiana . . . Air Medal with 10 Clusters, Distinguished Flying Cross recommended . . . P-38 Pilot. "I've helped escort the 'Sad Sack' on many a bombing mission . . . and seen Don Juster bullseye his bombs on plenty of Jerry objectives. And I want to tell you that's when *teamwork* pays off . . . teamwork that makes the A.A.F. the 'greatest team in the world'!"

When the escort fighters picked her up, the "Sad Sack" was on the spot . . . straggling behind her formation, with one engine knocked out by flak . . . trying to fight off a Focke-Wulf pack that was swarming in for the kill.

The sweetest sight her crew ever saw was that escort of P-38's . . . screaming down to the rescue with their noseguns squirting fire . . . chasing the Jerries out of there or shooting them down in flames.

That's why bomber-men call them "Guardian Angels", these escort fighter planes. For they bring back bombers and bomber crews to fly and fight again!

And that's the kind of team *you'll* be on when you wear A.A.F. wings . . . Pilots, Navigators, Bombardiers, Gunners, doing their job *together* . . . flying and fighting for the *team*, "the greatest team in the world!"

U. S. ARMY RECRUITING SERVICE

MEN OF 17 . . .

You can get ready now for your place on the great A.A.F. flying team. Go to the nearest Aviation Cadet Examining Board . . . see if you can qualify for the Air Corps Enlisted Reserve. If you qualify, you will receive the Enlisted Reserve insignia . . . but will not be called for training until you are 18 or over.

When called, your special aptitudes will be studied further to determine the type of training you will receive. For the A.A.F. not only builds a combat crew from the pick of the crop, but carefully selects for each position the man with the best capabilities for the job . . . and then adds the thorough training which makes this all-star team the world's finest.

Prepare yourself in advance by taking C.A.P. Cadet Training as given by your local Civil Air Patrol. Also see your High School principal or adviser about recommended courses in the Air Service Division of the High School Victory Corps. Both afford valuable pre-aviation training.

(Essential workers in War Industry or Agriculture—do not apply.)

For information regarding Naval Aviation Cadet Training, apply at the Naval Aviation Cadet Selection Board in any Office of Naval Officer Procurement, or at any Navy Recruiting Station; or, if you are in the Navy, Marine Corps or Coast Guard, apply through your commanding officer . . . This advertisement has the approval of the Joint Army Navy Personnel Board.

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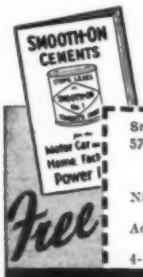

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Cycles Predict The Future

[*Continued from page* 42]

dead in warm ground which, in succeeding centuries, has been frozen solid. Since polar areas were once warm, but are now frigid, at some remote time they may be warm again: such is the history of climatic cycles.

Suppose the Greenland and South Polar ice caps eventually melt—what then? There is sufficient water locked in them now to raise the world's sea levels 150 feet! Release it, and we drown Manhattan in a shallow sea. A glass-bottomed boat draws up outside the twenty-second story of the Paramount building and its passengers peer with pity through staring windows behind which the editors of MECHANIX ILLUSTRATED once conned the findings of cycle scientists. The boat skitters northward and the sightseers study a submarine Broadway populated with different varieties of fish than dominated the street in the days of terrestrial ascendancy.

Fantastic? Not when you consider that a world temperature rise of only 2 *degrees* would be sufficient to melt all polar ice! Contrariwise, a world temperature fall of 10 degrees—no greater than the drop in home temperatures forced upon many of us this winter because of fuel shortages—would be more than adequate to bring on another ice age. Then New York's skyscrapers would be crushed by rending, crackling glaciers, and the edge of the ice mountain might again skirt Long Island, which began its present history as a mighty junk pile built up from glacial debris.

You are wondering what these tremendously long cycles have to do with our own times. They show the interlocking relations of all climatic cycles, in which the shorter ones are not different, but are merely easier to comprehend.

The most familiar short cycle, established beyond question, is that of sunspot recurrence. Sunspots are mighty whirlpools of incandescent gas erupting on the sun in pulsations of about 11 years —now numerous and violent, now few and weak.

Significantly, the most clearly marked weather cycles on earth are multiples of the sunspot cycle. The 170 and 510-year cycles of Dr. Wheeler fit well into the pattern, allowing for the fact that 11.3 years is the *average* length of sunspot cycles which may actually vary from 8 to 16 years. Even more striking are pronounced weather cycles of 23 and 46 years, magnificently charted by Dr. Charles G. Abbot of the Smithsonian Institution. Dr. Abbot finds that weather *tends to repeat itself every 23 years.* This interval is double the sunspot cycle, and actually represents the period required for sunspots *of the same kind* to recur.

Periods of drought and rainfall are closely tied up with 23 and 46-year cycles. Records of the levels of Lake Huron and Lake Erie, going back to 1837, reveal the relationship strikingly. During the first 5 years of the 23-year cycle, drought generally causes the lake levels to drop rapidly;

[*Continued on page* 142]

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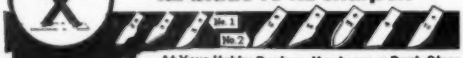

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Cycles Predict The Future

[*Continued from page* 140]

then there is a brief recovery, but by the eleventh year (the sunspot period) levels have dropped even lower. The next half of the cycle is generally wet, with a few regular recessions. From such cycles, Dr. Abbot believes that we will not have another great drought until 1975.

There is persuasive evidence that such fluctuations have been tied up with sunspots throughout history. The work of Prof. Andrew E. Douglass of the University of Arizona and of Prof. Ellsworth Huntington of Yale throws much light on the mechanism. These authorities are leaders in the field of tree-ring study. You have observed the concentric rings exposed by cutting a tree across its trunk. These rings reveal the annual rate of growth. Prof. Douglass theorized that a thick ring indicates rapid growth and therefore a year with plenty of moisture; a very thin ring would indicate drought. The rings are fingerprints left by the weather of past ages in ancient trees.

Delving into old records of weather and sunspots, Douglass found that tree rings had cycles of their own—they bunched characteristically at rhythmic intervals which turned out to be almost exactly correlated with sunspot cycles!

Following this lead, he eventually received a severe setback. A series of tree rings, dated between 1670 and 1720, disturbingly refused to fit into any sunspot cycle. The rings behaved as if there were no sunspots; they represented a "flat" period that was incomprehensible. The discovery threw Douglass into confusion; he was almost on the point of giving up the work. Then, from across the world in Greenwich, England, there came a letter from Prof. E. W. Maunder of the Royal Observatory. A friend, he reported, had unearthed from old records the astonishing fact that between 1645 and 1715 there had been almost no sunspots.

No wonder the tree rings had failed to record the sunspot cycles—they hadn't existed! Trees growing in Arizona had faithfully recorded weather which, centuries later, was confirmed from the other side of the world.

If sunspots are that important to our weather, the cycle deserves a closer look. In May of 1943 a new sunspot cycle began. From now until 1947-48 we may expect sunspots to increase; then they should begin to diminish and reach their low around 1954. The 11-year cycle really is in two phases, a 5½ year "up" and a 5½ year "down."

What kinds of weather will the cycle bring? Almost invariably, as sunspots increase, our weather grows colder. It warms up as they decrease. For the next five years we may expect increasingly colder weather, with a cold drought at the 1947-48 peak. Two-thirds of the months during years of high or rising sunspots show periods of unseasonable cold. Orange growers will do well to have their smudge pots ready during the next few years, and farmers should be

[*Continued on page* 144]

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Cycles Predict The Future

[*Continued from page* 142]

prepared for late spring and early fall frosts. At the peak of the cycle, say 1948, we may expect 40% more storms, and instead of the one or two severe hurricanes of minimum years we may anticipate 6 to 8.

But in compensation for the frigidity, we can reasonably look forward to increasing prosperity until the weather begins to warm up after 1948. Boom times are most often associated with periods of normal or low temperatures.

These few clues will have begun to give you an idea of the basic cause of weather. It is, in a word, the sun. Many conservative scientists would not accept that statement. It is true that local conditions—the effect of mountains, deserts, seas, the earth's rotation and inclination on its orbit—all influence the weather, but these influences are relatively fixed. More and more, scientists are agreed that the radiation of the sun, heating the earth, causing vast displacements of cold and warm air, produces the variations we know as weather—that the ultimate source of weather knowledge is the sun.

If that is true, and sunspot cycles are regular, why are not our weather cycles more clear-cut and unvarying? If the sun bathes the earth in a steady stream of radiation, then, allowing for local geographical factors, we should have the same kind of weather every day of succeeding years. We would know that it will snow every February third, that on July sixteenth of each year New York will have a heat wave of 92 degrees.

The truth is that the sun is a variable star. Its radiation is not constant, but varies almost 2%. If that sounds trifling, remember that a mere 2 degree world temperature rise, long continued, would drown New York in a tropic sea. Slight changes in solar radiation are greatly magnified in their effects upon weather.

Measurements of solar radiation, collected over many years by the Smithsonian Institution, have enabled Dr. Abbot to score with 60% accuracy in predicting the rise or fall of temperatures in Washington, D. C. The effects on temperature follow for 16 days after the change in radiation. Most recently, Dr. Abbot has predicted Washington temperatures with similar accuracy based upon cycles of calcium gas erupting on the sun.

When sunspots are numerous, the sun is hotter but the earth is colder. When they are few, the sun is colder but the earth is warmer. This reversal is attributed to increased turbulence and storminess caused by greater than average heating of equatorial air masses. Sunspots happen to be conspicuous, but there are undoubtedly other clues to other cycles operating in the sun, and therefore on the earth. Hydrogen gas eruptions may well reward study.

Somewhere, if we could descry the evidence, there are clues to solar cycles which might enable us to foretell with daily accuracy the world's

Cycles Predict The Future

weather for the next hundred years. They might even tell us what colossal convulsions occurred to trip the trigger on the ice age, and whether such a vast adjustment will again occur. Our own earth, as well as other planets, exerts a slight tidal effect on the sun. If this proves to influence solar cycles, then we can predict them as accurately, and on the same basis, as astronomers forecast the exact second of a lunar eclipse forty years from now.

Dr. Abbot has isolated 12 regular periodicities —12 ticking clocks—within the 23-year weather cycle. These range from 7 months to 23 years. Sometimes the 12 clocks tick in unison and we get intense periods of wet or drought; at other times the ticks are out of phase, they "erase" each other and we have relatively static weather.

But the master cycle of 23 years, Dr. Abbot is convinced, runs its course and then repeats. If you want to know what the weather will be in 1944, consult the day by day weather reports of your local newspaper for 1921. This April should be very similar to April in 1921. The master 23-year cycle says so.

"Sweating It Out"

[*Continued from page* 52]

procedure in case they are shot down and captured.

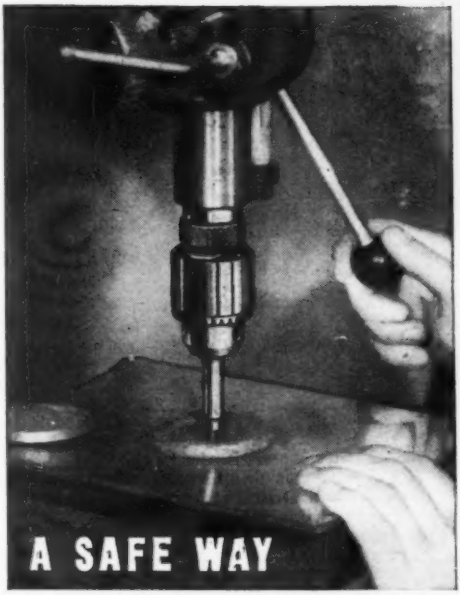
"It is only necessary that you give your name, rank and serial number," he says, probably for the twentieth time, but he says it as though he expected someone might be glad of the advice. There is further information for those who *might* be forced down in a neutral country and he closes with a cryptic reference to what he calls an escape kit. Everyone turns and looks at me with bloated eyes whenever this escape kit business is mentioned. One of these days I'll find out what that was all about.

On another blackboard will be seen all the navigational data which is hurriedly copied off. A Meteorologist gets up and has an enlarged weather map thrown on the screen and there they see the predicted conditions all the way out and back. Somewhere above the briefing room, probably at 27,000 feet, a plane is aloft and a skilled crew is collecting additional weather data that is being radioed down—in code—and added to the gathered information every fifteen minutes.

The "sweating out" period is on now for keeps. Any minute a new weather report might come down and the mission will be scrubbed. You find yourself quietly praying for these boys and hoping they can go—and get it over. You're wondering how many of them will come back, but you're "sweating out" with them now, wondering what you're wishing.

They get details of cloud formations on the

[*Continued on page* 146]



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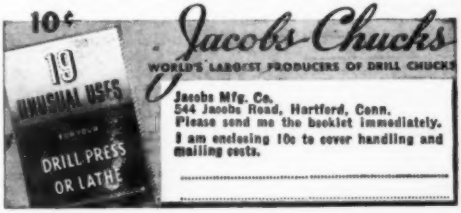

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"Sweating It Out"

[*Continued from page* 145]

weather map. It shows the prevailing icing levels, winds and precipitation data. Nothing is left to chance. Questions are asked in husky voices and they are answered as the light goes on and off, bringing out the sooty shadows on faces jeweled now with anxious, alert eyes.

Then the Group leader, a tall slim Colonel with silver at his temples, takes the rostrum. You sense he wants to talk of something else, but he goes on with his explanations and detailed requirements. You'd never guess that he, too, is going along. He wears the simple expression of a worried banker, but he goes along, as he explains, because he thinks he *ought* to back up his kids every third or fourth show.

He explains again what they can expect in the way of Flak and fighters and the young Captain next to me says in a husky whisper: "This will be a milk run. You ought to come along with us. I'll take you if you'll go. I have an extra observer's seat in my ship. You could sit up there and see it all—and you can even be hooked in on the intercom. Why don't you come along? This will only be a milk run!"

I whispered back that I'd go, if I could get permission.

But I didn't get permission that time, and it was no milk run. The young Captain was shot down in flames a few miles short of the target.

The Colonel was saying: "There will be some fighter opposition over the target—but not much. The run-in will be fairly simple, but I want a good pattern. I insist on it. Nothing less. If you get into trouble. . . ."

There was that name, rank and serial number business again and the second announcement that they were to pick up their escape kits on the way out.

"This will be a milk run," the young Captain was saying.

The Tannoy grumbles again and outside the monsters are warming up their thunder boxes and the boys clamber up into the trucks again, and they are off. A young Flight Surgeon takes me over to the control tower in his ambulance and we climb up a wind-lashed ladder to an elevated platform and watch the bombers rumble out of their bays, around the perimeter track to the end of the runway.

Below, our ambulance still ticks over and a crash cart stands next to it with everyone alert. One by one they roar away, indistinct masses of bellowing authority at 30-second intervals. Somewhere above amid the sudden sequined scarf of stars we spot faint red and green lights.

The Liberators are assembling—the young Captain's words come back to me—"This will be a milk run."

Glass blocks gain insulating effectiveness by having a hollow center from which most of the air is removed.

"One Hippopotamus"

[*Continued from page 37*]

Frederico Pilon of Roma, Texas called the shots.

"Ack-ack at seven o'clock. Ack-ack at eight o'clock. Five o'clock. Six o'clock." Suddenly the heavens turned black and we were literally enveloped in the smoke of bursting anti-aircraft shells. "Aw hell, ack-ack all around us," Sergeant Pilon complained. "You worry about it."

I was worrying about it—plenty. I kept pulling on the stick, goosing the plane up and down and from side to side in violent evasive action. It's a tough trick for every ship in the flight to do and still keep in formation.

We came in over the target area and the bombardier in the lead ship—the only one who actually does any aiming—got on the beam and began to toggle. Eight three-hundred-pounders dropped at one second intervals. On the ninth second he began to toggle the thousand pounders. That was our signal to begin. We let go with our one-thousand-pounders first, and finished the run with the lighter bombs.

This made a burst pattern on the ground of concentrated thousand pounders in the center, where the lines of communication met, that was ringed by three-hundred-pounders which theoretically burst on the sides of the road where the enemy's motor transport was concealed.

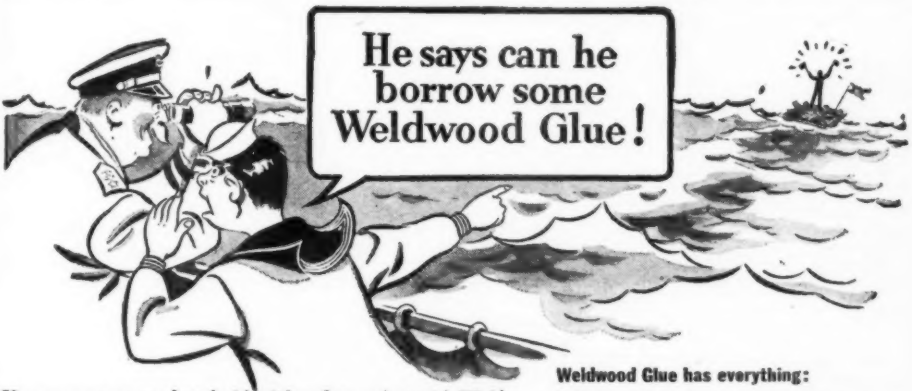
There were dozens of flak holes in our ship when we banked and dived away from the target. None of the planes was lost nor were any of the flyers seriously injured. We hit Randazzo a dozen times in crushing raids before it folded up.

Enemy airdromes are also an important type of target for tactical bombing. They require a somewhat different bomb pattern. On the morning of September 3, 1943 we were alerted on immediate stand-by. Along with the rest of the boys in the squadron, I spent the morning hanging around the operations tent. Finally TBF telephoned that our target was to be the airport at Commigliatello. The Germans had a large number of ME 109's and FW 190's based there and were using them as dive bombers to play havoc with the British Eighth Army's advance in Italy.

Lieutenant Touchstone, operations officer, blew a V for victory on an auto horn and we all grabbed up our equipment, piled onto trucks and were driven out to group operations which was on the flying line. Here the briefing officers pointed out our forward troops, the target area and the position of the German anti-aircraft guns.

There were to be forty-eight planes in our flight, all carrying sixteen three-hundred-pounders. My ship was number four in the second box of the lead formation. We took off at 1220

[*Continued on page 148*]



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DIC-A-DOO
PAINT BRUSH BATH

"One Hippopotamus"

[*Continued from page* 147]

and rendezvoused at four thousand feet over Lake Lentini. Here we picked up a top cover of Spitfires and a bottom cover of P-40's. Then, flying in a wing-tip to wing-tip formation, we soared out over the Straits of Messina and up the south coast of the Italian boot.

I saw huge columns of smoke billowing skyward as we neared our mark. Our objective was a pair of twin airports nestled in a valley. As we came in over the mark ack-ack guns evenly spaced around the perimeter of the fields opened with all their fury. Most of the Nazi ships were parked in revetments along the sides of the field. Only half a dozen fighters managed to take to the air before we began toggling our bombs.

It was perfect bombing weather with broken stratus clouds at twelve thousand feet and visibility unlimited. Heavy black smoke pouring thousands of feet into the air showed where the oil stores had caught fire and the brittle bright light which is peculiar to burning planes gave an indication of the tremendous destruction we visited on the field.

An enemy FW 190 spiralled up toward us and two P-40's dropped away to meet the threat. We kept speeding across the toe of the Italian peninsula and over the Tyrrhenian Sea.

The tension disappeared like magic. We all broke out cigarettes and puffed away contentedly. This was the part of the trip we enjoyed most. Going out we were working for the government, but coming home we were working for ourselves.

"We just gotta fight our way back—I'm working on the word game contest in MECHANIX ILLUSTRATED!"

WIN CASH!

ON PAGES 61-63 of this issue is the great MI Buildwords Contest. You'll want to enter it. But why not win some extra cash by getting your friends in on the contest, too?

Write your friends. Tell them about the contest. Ask them to enter YOUR name on their contest entries as SPONSOR. If one of them wins first prize, you will get $100.00 in cash! If one of them wins second prize, you will receive $50; if one of them wins third prize, you will receive $25 in cash. And there are FIVE additional Sponsor prizes of $5 each.

Remember, if you get one of your friends to enter the contest and he enters your name as his Sponsor—and if he wins one of the first eight prizes, you will win a cash prize yourself.

For your convenience, we reproduce a handy coupon below by which you may notify your friends about Buildwords. But notify as many of them as you can—for the more that enter, the better chance you have of getting that extra cash!

WIN CASH!

Dear _____

I think you can win $1,500 in War Bonds—or at least one of 100 prizes totaling more than $5,000.00. For details, see the Buildwords Contest now appearing in MECHANIX ILLUSTRATED Magazine. You'll find it on your newsstand.

I hope you enter. For if you do, I may win $100.00 in cash as your Sponsor. Please put my name down on your entry blank as your Sponsor.

It's a whale of a contest, with no catches in it, no "slogans" to write. The highest score wins. Please enter the Buildwords Contest in MECHANIX ILLUSTRATED *NOW*.

In the World War, airplane engines had to be overhauled every 50 hours, today they can go 600.

To inform the public about passenger train schedules, American railroads turn out about 80 million time tables a year.

If the United States should ship dehydrated vegetables to England, a year's vegetable supply for one Briton—which would ordinarily be 1,000 pounds—would be shipped at a weight of 110 pounds.

A new enlarging paper for photography is designed to make possible enlargements of all degrees of contrast.

About 85% of the cross-ties laid by railroads are now chemically treated to preserve them, compared with about 43% in 1920.

FINISHING TOUCH

...TO SPEED THE GOOD SHIP

HERE you see a ship's propeller blades being given a last-minute dressing—to add that fraction-of-a-knot speed which may mean the performance of some vital war errand in the nick of time.

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Secret Weapons

[*Continued from page 49*]

with vicious accuracy at moving targets. Today these electric precision sights are placed in Vickers electro-hydraulic power turrets which control a gun's tendency to align itself with the windstream.

The Germans have nothing as good in the way of aerial armament controls. And only the Allies have the gyro flux gate compass—the second new compass in more than 4,500 years, a direction indicator, controlled by the earth's magnetic field, which never oscillates, lags, or overshoots and gives automatically corrected readings.

The U. S. Army has learned how to hoist a 75 mm. cannon into the skies in the lethal nose of a B-25—a plane weapon so potent that it already has sunk a Japanese destroyer singlehanded. A special mechanism renders quite harmless the cannon's kickback, which would ordinarily tear a plane to bits. German scientists have labelled this whole development impossible.

So far the Germans haven't come through with anything approaching the new British-American jet-driven plane, which is already in production. They can't duplicate the gyroscopic mounts for our tank guns, which permit greatly improved firing accuracy during travel over the roughest terrain. Their turbosuperchargers, which permit fighting planes to soar into the thin air of the stratosphere with undiminished power, don't measure up to ours.

What, actually, have the Germans produced in the way of secret weapons, besides sensational rumors? There was the "iron crab," a movable, two-man, ventilated, steel pillbox containing machine guns and range finders, which can't stand up under our bazooka and heavy artillery fire. There was the anti-tank torpedo, a kind of small tank operated by remote control which the Russians squashed by cutting its control cables. There were the teller anti-tank mines and "bouncing betty" anti-personnel mines, which no longer take a significant toll now that the Allies have well-trained sapper units to smell them out.

The Germans gave a big play to their aerial rocket guns mounted on fighter planes, which were to sweep the skies clean of Allied craft. These were effective weapons against the American bomber attack on Schweinfurt, costing us 60 ships, but they have already been countered. Similarly, the German magnetic mine caused considerable damage to our shipping until the degaussing belt, perfected on the double, rendered it harmless.

Today the Berlin rumor experts are talking big about the "bumblebee" gun, supposedly a sort of "super-surface torpedo" releaser whose projectiles hum over the water like giant bees. This is evidently a weapon devised to damage sea-born invasion forces. The German press claims that this and other types of rocket missiles have tremendous penetrating force, and are loaded with a new explosive of unequaled destructive power.

Secret Weapons

At this moment we have no way of separating fact from fiction in all these reports. But we would do well to recall that our own scientists are not exactly slouches when it comes to rocket warfare. The Russians demoralized German troops and sent them into precipitate flight from Stalingrad with dense rocket salvos; Russian Stormovik ground fighter planes accelerate their bombs with rockets; and we have the now famous bazooka. We can rest assured that our experts will be able to duplicate whatever the Germans produce, and go them one better.

In 1942 one of General Electric's factories received from the Army's Ordnance Department a handmade model of the bazooka gun. Within 30 days several thousand bazookas had been delivered to the armed forces.

There is the Allied answer to any secret weapon Hitler can dream up.

Rapid cooling hardens ordinary steel, but it softens chromium-nickel stainless steel.

British engineers report that rubber fenders for automobiles and trucks resist denting, are waterproof and rustless—and save metal.

Despite its thick ice blanket, Greenland possesses rich seams of coal formed from vegetation when the land was far warmer.

When you sit around your fire o' nights, those crumpled up newspapers having been the kindling source for the fire, remember that 100 pounds of newspapers will make 200 containers for blood plasma. Or when you carry out those old, seemingly worthless magazines and pull them apart to add to an incinerator's devouring record, keep in mind how many cases for ammunition you are guilty of destroying. Scrap paper is a MUST.

In the last war, outboard motors were in their infancy. Today Johnson Sea-Horses are doing man's work in the armed services. It took lots of development to bring them along so far... lots of experience in outboard design, metals, manufacture.

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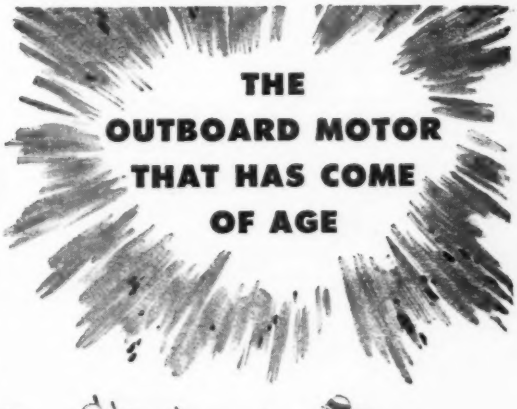

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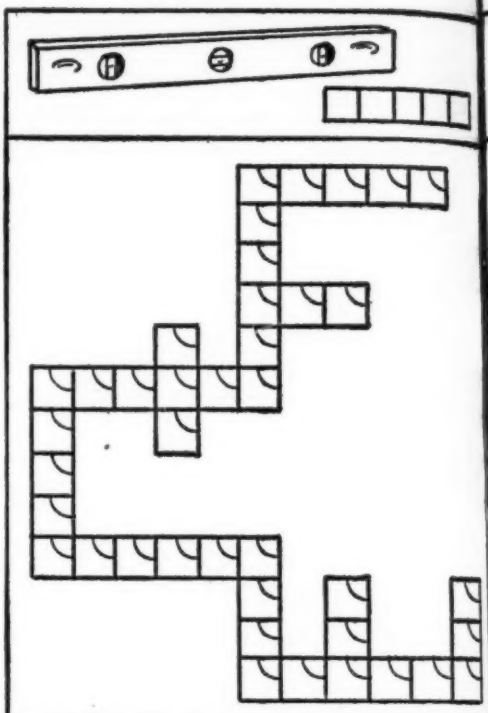

LETTER VALUE CHART

A	3	G	4	M	1	T	4
B	J	H	6	N	8	U	1
C	8	I	2	O	3	V	6
D	5	J	7	P	2	W	7
E	2	K	1	Q	4	X	2
F	7	L	5	R	2	Y	5
				S	6	Z	3

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PUZZLE NO. 2

LETTER VALUE CHART

— 2	G — 6	M — 2	T — 3
— 3	H — 2	N — 6	U — 2
— 4	I — 7	O — 3	V — 4
— 8	J — 1	P — 7	W — 1
— 5	K — 3	Q — 1	X — 6
— 1	L — 4	R — 5	Y — 4
		S — 8	Z — 5

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ADDRESS .....

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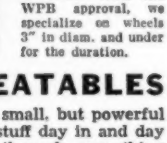

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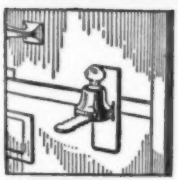

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Editor's Workbench Chips

[*Continued from page* 16]

Looking ahead to the MAY MI, we think a lot of such highlights in that issue—such as:

MAGNETIC "JUICE": Willy Ley, MI's science expert, gives you the facts of a discovery that may be a world shaker in the science field.

CAPTURED JU 88: Major Newby tells how he crossed the Atlantic in the new Nazi fighter that was mysteriously delivered to our Air Forces intact by a German pilot.

CAN-DO-BOYS: Ed Kelly gives you some candid glimpses of those miracle workers, the Navy Seabees, whose gags are as spectacular as their guts.

BEARINGS: The story of the ball bearing and the vitally important part it plays in war and peace.

COTTON CANOE: Priorities needn't spoil your boating pleasure next summer. Plans and instructions for building a simple, light-weight canoe.

PIPE MAKING: Have you pipe smokers any idea of how the old hayburner got that way? Did you know you can easily add to your pipe collection by making a few yourself? Here's how it's done.

In 20 years, scientists studying bird habits have banded more than 3,000,000 birds, and have obtained reports later on 200,000 of them.

HOME-BUILT RECORDER

Paul Overby, 2004 S. 10th Ave., Maywood, Ill., built this neat looking recorder-phonograph-radio unit. It can also be used as a public address system. Mr. Overby tells us that he has made about 100 recordings with it, and finds it quite satisfactory. It can record directly from the radio, or through the microphone. This snapshot nets Mr. Overby a $3.00 Workbench award and a Certificate of Merit.

WORKSHOP WISDOM

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Sons Of Martha

[*Continued from page 66*]

transported by air. With the beginning of the Italian campaign the figure jumped to 90 percent.

The job of repairing the thousands of planes in the AAF is as mighty a task as supplying them with equipment and spare parts. In this country there are more than 200 sub-depots which contain permanent repair installations. Out of these sub-depots work still smaller units known as service squadrons. In battle zones, the service squadrons are the closest to the fighting lines. They are mobile units, operating mobile repair machinery. It is their task to locate our planes which have been forced down and haul them to the nearest point where they can be repaired and sent off to battle again. Frequently, however, the highly-skilled units have carried out extensive repairs on a plane, even with their very limited equipment.

What is known as fourth echelon work comprises heavy or intricate overhauling jobs. This is done in the 12 main depots or command centers in this country and in similar installations overseas known as air depot groups. This type of work is done in buildings or hangars and with stationary machinery.

The third major division in the Air Service Command is Personnel and Training. In addition to some 300,000 civilians on its payrolls, there are tens of thousands of officers and enlisted men in its ranks. This involves a gigantic training program, training chiefly for the Supply and Maintenance Divisions, as well as miscellaneous ASC operations. Before Pearl Harbor the majority of the skilled mechanics who today are performing mechanical miracles on the battlefronts were clerks, farmers, storekeepers, carpenters, salesmen, etc. In the big ASC repair installations in this country, women comprise over 40 percent of the working personnel. They all have to be trained from scratch.

In the theaters of operation, the task is simplified. The single purpose of the 13 guys on the ground is to keep their planes in the air and in combat condition.

Take the 13 doughboy mechanics in Italy who rebuilt a damaged fighter plane under enemy fire. Members of a mobile repair unit trained in handling repairs in the field, they knew how to do it.

The fighter had run into heavy ack-ack fire over German lines. Her pilot was wounded, but he still managed to bring her back to an emergency airfield on our side.

Big odds are at stake when even one fighter is out of the air during a major campaign, and the 13 guys on the ground knew that. When they arrived with their mobile repair unit, they found the plane's wings had been riddled by flak and were no longer of any use. Nearby, though, was another fighter of the same type. It had nozed over while landing and lay on its back. Its fuselage was worthless, but its wings were intact.

With a boom and winch attached to their truck,

Sons Of Martha

they removed the wings from the overturned plane and attached them to the flak-damaged craft. Then they patched up the holes in her fuselage. Working throughout the day and night, with the battle going hot all around them, they completed the job.

They stayed to watch another pilot gun her into the air and head back toward the German lines.

And then there's a typical story of GI ingenuity like the one about Corporal John Raygoza, a doughboy mechanic in North Africa. The men in his service squadron were baffled over the loss of twelve newly-arrived fighter planes because the rudder hinge brackets on each one of them had been cracked during the long flight to the forward base. They were useless.

The damaged parts would have to be sent back to the United States, since no replacements were available over there. This would mean that the twelve planes would remain idle in the hangars for at least a month. Or maybe longer, if engineers back home decided to study the broken parts to discover a manufacturing defect.

At this point young Raygoza, wearing two stripes over a T on his arms, stepped forward. He had an idea for getting those planes in fighting trim without having to send them home. His engineering officer told him to go ahead and try it.

T/5 Raygoza began rummaging through bodies of wrecked French aircraft scattered about the field. He filled a dozen buckets with scraps of aluminum, copper and nickel, stripped from the dead foreign birds. He then renovated a French furnace so the metal could be melted. Combining the aluminum with two percent copper and five percent nickel, he was ready to begin moulding. But no equipment was available. He decided to use common dirt for moulding sand. An ordinary knife and spoon served for a double-under and trowel. Toilet tissue occurred to him as the best available thing to use for parting the sand and forming the mould.

Improvising as he went along, Corporal Raygoza cast the brackets in solid form, then fluxed them with a solution of table salt and water and machined them to the correct size and weight, using a hand-turned milling cutter and antique French machining equipment for want of something better.

Working non-stop for thirty-six hours, Raygoza made 12 new brackets that put the grounded planes back into the air a day and a half after they landed.

Raygoza is but one of thousands of battlefront Thomas Edisons who have blazoned forth with striking ingenuity and originality in a tent-covered machine shop in a foreign land.

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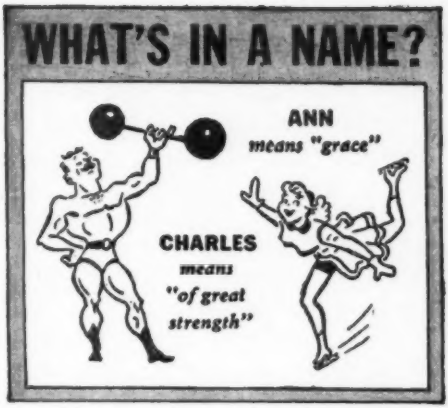

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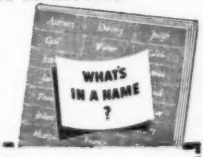

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Continent Of Tomorrow

[*Continued from page 57*]

Opportunity is knocking loudly on that Paraguayan wood.

In a way agriculture down there is almost automatic. For example, Paraguay is the only country in the world where oranges grow wild. Talk about Yellow Gold in Paraguay! An area about as big as the State of Connecticut in this little country is covered with orange trees. Oranges yield so plentifully that they are fed to the pigs, just as Illinois farmers feed corn to the livestock. Orange marmalade, paste and perfumes could be made profitably from the enormous orange waste.

What about going into tea farming? They call *mate* "Paraguay tea" down there, because so much of it comes from that country. If all the tea grown in Paraguay were brewed at one time, there would be enough to make one cup for every man, woman and child in the world. There are 25,000 square miles of it growing wild. Indian boys strip the leaves from the trees, dry them over wood fires, pack them in green cowskin bags, and there's your tea all ready to drink. Twenty million people down that way drink *mate* all day long, some of them 15 or 20 cups a day. North Americans are drinking it more and more. American enterprise with proper advertising could put it on the American breakfast table.

The principal crop of Paraguay, however, is cotton. It makes up one-third of the country's export. The leading buyer of their cotton is Argentina, just down the river. Next comes the United States. And yet, the cotton situation hasn't even been nicked. Seventy-five million acres along the Paraguay River are deemed suitable for cotton. Cotton possibilities in El Chaco are unlimited.

Tobacco is another one of their important crops, in which almost unlimited improvement with profit could be made by Americans who would lend a helping hand. To begin with, large quantities of the unimproved article are consumed in Paraguay itself. Everybody smokes like a chimney. But there are many changes that have to be made in the growing and blending of Paraguayan tobacco before that can be done successfully. They've got everything just right for good tobacco in unlimited quantity, except the good tobacco.

Most of the news you get about Paraguay has been to the effect that it is a desolate and Godforsaken country. Don't you believe it. The place used to be full of Germans, but it will be some years before they have anything to sell again. And the English—they are going to be too busy mending their shattered empire. Now, we can sell them the cotton and woolen goods once sold them by Germany and England. And woolen shawls, that used to come from Germany and Belgium. The same with the hardware market—axes, saws, revolvers and sewing machines. What we need is a few thousand live Americans.

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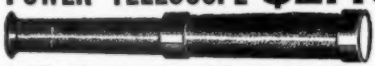

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A Guy Called Ed

[*Continued from page 45*]

phenomenal qualities, for five years purchasing commissions from all over the world rejected the Fortress because of its virtues. The experts said that it was too big, too complicated, flew too high for practical bombing and was undergunned. Wells argued against most of these contentions and made some changes in design. The tail gun was added and then more guns till the Fortress' armament was sticking out from every angle.

Fortunately, the Fortress has a number of stout friends in our army, which adopted the superbomber in 1940. But it was still being discredited by experts until it went into combat and demonstrated its sensational performance. Its detractors were finally hushed. Winston Churchill was impressed by the "new possibilities of air warfare . . . being opened up by our American comrades and their Flying Fortresses." And a Congressional committee stated that "the success of the new Flying Fortresses is likely to lead to a drastic resorting of basic ideas on air warfare which have stood firm since the infancy of flying."

Ed Wells' engineering genius had soared beyond this point long before the Flying Fortress was proved in combat. For the past three years he has been working on a super-bomber which would relegate even the Flying Fortress to a minor position. The success of this project, the B-29, has just been announced by General H. H. Arnold, commanding general of the Army Air Forces.

This new product of Ed Wells' fertile brain is so far superior to the Army's present superbombers, said General Arnold, that when it enters combat the Flying Fortress and the B-24 Liberator will become medium range light heavies. This battleship of the air (the B-29) will have a range substantially greater than the maximum effective range of today's longest-range heavy bombers and will carry large bombloads for that distance. It is armored heavily with multiple-gun power turrets and can fly at very high altitudes.

As an aeronautical engineer, Ed Wells has affected the destiny of nations, but his manipulation of aircraft stops at the drawing board. He has never handled the controls of a plane himself.

As a matter of fact, he is a model railroad enthusiast and has been tinkering with them since childhood. A model railroad layout with all the trickiest gadgets fills his basement. Some time ago his model railroad grew to such proportions that it threatened to bulge out beyond the basement walls. About the same time the Wellses decided to move. The new house had a larger basement to accommodate the railroad.

He visions for himself a future in the railroad business. The railroads will be so far outdistanced by air transport that they will require a major job of engineering and design to meet the competition. He wants to get in on that. It should, he thinks, be lots of fun.